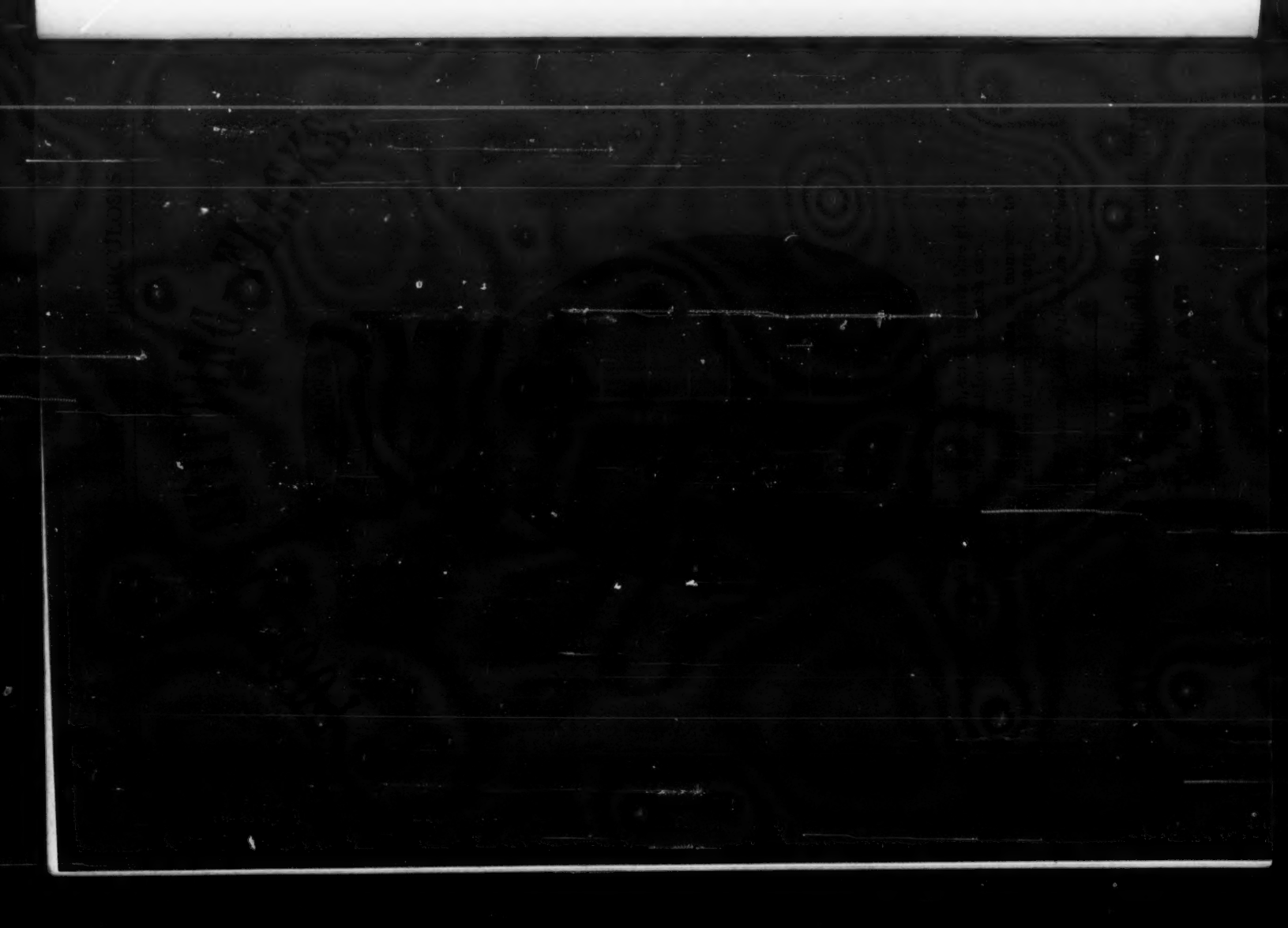

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EDITORIAL

TUBERCULOUS EMPYEMA COMPLICATING PNEUMOTHORAX

When artificial pneumothorax was started as a treatment for pulmonary tuberculosis, it was found that pleural effusion occurred far more frequently than it did in cases not so treated. It was suggested that the effusion was due to irritation of the pleura by frequent punctures, or by the gas used for refills, or by the temperature of the gas or the rate at which it was introduced into the pleural cavity. Various methods were used in order to prevent this complication. The needle was inserted in different parts of the chest so that the same part of the pleura should not frequently be punctured, the gas was warmed, different sorts of gas were used—air, carbon dioxide, nitrogen, oxygen or helium were tried—but still pleural effusion occurred as a common complication. In 1926 Burrell suggested that these effusions were true tuberculous exudates, and not directly due to the treatment or any mechanical cause connected with it. He pointed out that pleurisy was an extremely common complication of pulmonary tuberculosis, and if the visceral and parietal layers of the pleura were in contact the result in most cases was to form adhesions between the two layers. If they were separated by pneumothorax the exudate forming could not result in adherent pleura but must lead to effusion, small or great according to the severity of the pleurisy. He also drew attention to the facts that the effusion occurred early in the treatment and not late as would be expected if it was due to irritation of the pleura by constant puncturing or to the gas, that it was as common in hot as in cold weather, and that the cytology of the liquid was that of an ordinary tuberculous

exudate. He remarked, moreover, that where pneumothorax was induced for non-tuberculous disease effusion was practically unknown. It has been recognised for many years that spontaneous pneumothorax of non-tuberculous origin rarely leads to an effusion, which is almost a constant result in tuberculous cases. He stated that if the effusion absorbed and the lung did expand, or could if refills were stopped, the complication of effusion was not serious; but if it persisted, and especially if it became tuberculous pus, the prognosis became very grave indeed. He wrote: " I have washed out the pleural cavity " (*i.e.*, in cases of tuberculous empyema in which the lung would not re-expand) " with saline, normal or hypotonic, I have injected a 2 per cent. solution of formalin in glycerine or other disinfectants into the pleural cavity, and in cases where the pus is thick I have injected some modifying fluid and rendered the pus more liquid and easier to aspirate, but the end is the same. If, therefore, the fluid is purulent and the lung fails to re-expand, I think the best chance for the patient is to perform thoracoplasty as soon as possible."

In the same year Hutchinson and Blair published a paper in which they expressed the opinion that some of these effusions were due to a tear in the treated lung. It is not difficult to believe that when an adhesion anchors the lung to the chest-wall a strain is thrown upon the attachment by cough, and that a small tear is likely to occur in the visceral pleura at the juncture of the adhesion. Moreover, the theory of Hutchinson and Blair explains the well-known alteration in physical signs which occurs when, or sometimes just before, the effusion develops. A coin sound is heard, the breath sounds may be amphoric, the pressures at the next refill are altered and the lung, if only partially collapsed before, becomes completely collapsed. This complete collapse of the lung after the appearance of the effusion was ascribed by Burrell to the fact that the weight of the liquid completely deprived the alveoli of air, and it is probably true that a group of air cells absolutely collapsed finds it more difficult to re-expand than do those cells in which there still remains some air. It seems to us that the importance of the work of Hutchinson and Blair has not been sufficiently recognised.

Coryllos, in a recent publication, has thrown light on this problem, and has not only added scientific proof to the suggestion that many effusions in pneumothorax treatment are due to a rupture of the visceral pleura, but has also given a definite lead to the correct treatment and to prognosis. He is the first to point out that a tuberculous empyema with a pulmonary

fistula is in effect a big cavity, comparable to a cavity in the lung tissue and just as dangerous. By means of gas analysis he has proved that many of these cases are the result of a tear in the visceral pleura. He has demonstrated that in the absence of effusion pleural air contains 3 to 4 per cent. oxygen and 6 per cent. carbon dioxide. In the case of clear effusion the proportions are O_2 1 per cent. and CO_2 6 to 8 per cent. If the liquid becomes purulent the oxygen in the air above it drops to under 1 per cent. and the carbon dioxide rises to over 8 per cent. Atmospheric air contains 20·7 per cent. oxygen and 0·03 per cent. carbon dioxide and alveolar air 15 per cent. O_2 and 6 per cent. CO_2.

The result of a bronchial fistula must be to increase the percentage of O_2 and decrease that of CO_2 in the pleural air, and the size of the fistula can be judged by the degree of alteration in the pleural air. In one case to which he refers the pleural gas contained 1 to 1·5 per cent. O_2 and 9 to 10·5 per cent. CO_2. Purulent effusion occurred, and the pleural gas altered to 14·2 per cent. O_2 and 3·8 CO_2, thus indicating the presence of a large bronchial fistula.

If the percentage of oxygen falls and that of carbon dioxide increases the prognosis is good, because the fistula is healing and the lung will re-expand or will need refills to keep it collapsed. A persistence of a high percentage of oxygen indicates an open fistula and a bad prognosis. In such a case thoracoplasty to close the pneumothorax cavity is indicated, because to leave it open is to expose the patient to dangers similar to those of a large pulmonary cavity.

There is another issue arising from this work, namely the danger of cauterising adhesions. The percentage of patients who develop effusion after this operation is not perhaps considerable, but it is definite, and before deciding to cauterise an adhesion with the view of allowing a suspended cavity to collapse, ought one not to consider the risk of creating another and more serious cavity between the layers of pleura ?

If the perforation in the visceral pleura heals the outlook for the patient is good if, as so often happens, a residual effusion remains. Such an effusion is usually confined to the axillary region, and is best left alone even if it consists of tuberculous pus or the so-called cold abscess. But if there is air and pus, that is to say if the perforation has not healed, the outlook is very grave and thoracoplasty offers the best hope.

Air analysis, as advocated by Coryllos, will enable the physician to detect this state of affairs and to regulate his treatment accordingly. Those

who regard a tuberculous cavity as all-important will read with interest this paper by Dr. Coryllos, and in their zeal to close by pneumothorax an intrapulmonary cavity will not forget the risk of making a far more dangerous one between the layers of the pleura.

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TYPES OF PULMONARY TUBERCULOSIS

2. CREEPING TUBERCULOSIS

By L. S. T. BURRELL,

M.D., F.R.C.P.,

Physician to the Royal Free Hospital and to the Brompton Hospital for Consumption and Diseases of the Chest.

In April, 1932, a boy of eleven was taken to the doctor because his mother thought he was run down, and she was especially anxious since his elder sister had pulmonary tuberculosis. No physical signs were found, and a radiograph of the chest showed no abnormality. The sister died in the summer of 1932, but the boy remained in fair health until December, 1932, when he developed a right-sided pleural effusion. Plate IV, Fig. 1 shows the condition in January, 1933, and Plate IV, Fig. 2 that a month later, by which time the temperature and symptoms had subsided, and it will be seen that the effusion had absorbed.

He had no cough or sputum, his general condition was good and his weight was 6 stone 11 pounds. After a short convalescence at Broadstairs he returned home and lived a normal life, but kept under his doctor's supervision, and periodic clinical and X-ray examinations were made. In November, 1934, some fluffy mottling (Plate IV, Fig. 3) was seen at the left apex and a little at the apex of the right lung above the clavicle. He felt and looked well, had no symptoms, and his weight had increased to 9 stone 2 pounds. In view of the X-rays, however, he was sent to Davos for the winter. He kept in good health without symptoms, but X-ray showed a steady but very slight spread of the disease, so he returned to England in the summer 1935.

In December, 1935, he had a short febrile attack with slight cough but no sputum. X-ray (Plate V, Fig. 4) showed a definite spread in both lungs, and he had a long period of rest at home, and in April, 1936, returned to Davos for two months. On his return he felt and looked well and was apyrexial and free from symptoms. He went to school and led a normal life, even playing tennis and other games without any feeling of distress.

In July, 1937, his weight was 9 stone 12 pounds and he was still fit and at school, but X-ray (Plate V, Fig. 5) showed considerable spread in both lungs. He was allowed to remain at school, but a course of tuberculin was started. The initial dose was B.E. 0·1 of dilution 5 (1 in 100,000), and this dose was doubled at weekly intervals.

In January, 1938, he was still in good health, being able to lead a normal life without dyspnœa or fatigue, but X-ray (Plate V, Fig. 6) showed a still further spread, and there is now a considerable amount of disease in both lungs.

On one occasion throughout this case, which has now extended over a period of five years, a specimen of sputum was obtained when he had a cold, but tubercle bacilli were not found in it. Apart from this it has never been possible to obtain a specimen of sputum for examination. Tubercle bacilli have not been found in the fæces.

In spite of rest both in Switzerland and in this country the lesions in the lungs have steadily increased. Tuberculin caused no reaction and appeared to make no difference one way or the other and was stopped after four months' trial.

At present he is living at home and going daily to work at an art college.

If Fig. 1, which was taken in January, 1933, is compared with Fig. 6, taken in January, 1938, it will be seen that a great change has taken place, but it has taken five years to develop, and throughout the whole time the boy has been in good health. There are no symptoms even now and practically no physical signs, so that but for the radiographic changes he would be regarded as a perfectly healthy boy.

This type of case is sometimes seen in families who include a member with active tuberculosis; other members of the family get repeated small doses of infection, some too small to have any effect, but others large enough to produce a lesion but not enough to cause toxic or other symptoms, so that X-ray examination of contacts in such a family occasionally reveals advanced disease in a subject apparently in normal health.

A similar condition is seen in China, possibly because the Chinese have become tolerant to tuberculosis after many centuries during which they have been in contact with it. Descriptions of lung cough and lung fever are found in the *Canon of Medicine*, which is said to have been written about 2650 B.C. Hall (*B.J.T.*, 1935, xxix. 133) wrote: "The disease appears in the majority of instances in a peculiarly chronic and non-toxic form. One is frequently amazed to find it so advanced as to be completely beyond the hope of cure in patients who, to within a few months of presenting themselves for examination, have had practically no symptoms and suffered not at all from their disease."

If the spread of the disease is due to separate small infections the obvious

PLATE IV

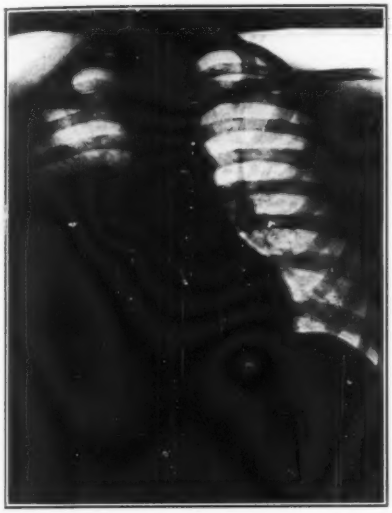

FIG. 1.—JANUARY, 1933.

FIG. 2.—FEBRUARY, 1933.

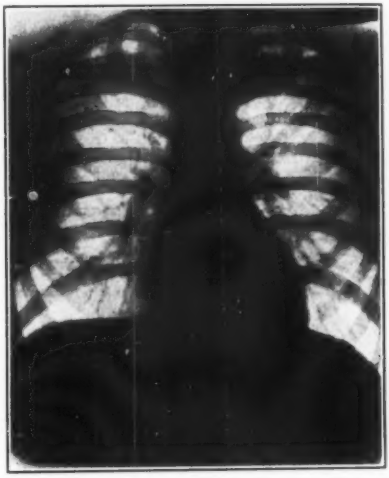

FIG. 3.—NOVEMBER, 1934.

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PLATE V

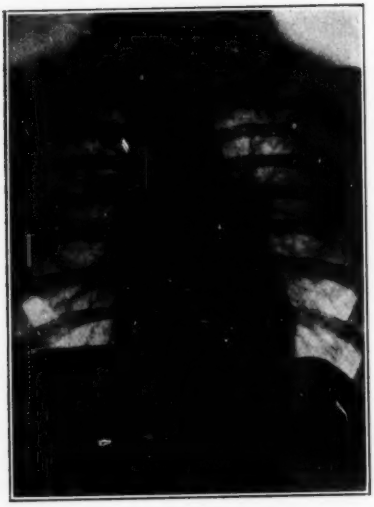

FIG. 4.—DECEMBER, 1935.

FIG. 5.—JULY, 1937.

FIG. 6.—JANUARY, 1938.

[*To face page* 66

treatment is to remove the source of infection, but in the present case this is not the cause. It is easy to understand the opposite type of case, the so-called galloping consumption, on the grounds of an infection which is excessive for the patient's size or state of resistance, but this slowly spreading type is remarkable.

If the patient has enough resistance to make the rate of spread so extremely slow, why is it not checked altogether? Is it a slow lymphatic infiltration?

No treatment appears to have any effect, and such cases usually progress slowly but steadily until there is a sudden breakdown and the patient dies of miliary tuberculosis or broncho-pneumonia.

GENERAL ARTICLES

EXTRAPLEURAL PNEUMOTHORAX

By J. E. H. ROBERTS, O.B.E., F.R.C.S.,
Surgeon to St. Bartholomew's Hospital and to the Brompton Hospital.

Since Tuffier first used a lipoma to fill the extrapleural space produced by apicolysis and so to maintain the collapse of a part of the lung, many substances from wax to muscle have been used. Curiously enough, air itself, though tried, has always been abandoned after a short trial. It is probable that the failure to maintain the air space was due rather to inadequacy of the volume and spacing of the refills rather than to the escape of the air. Graf of Dresden in 1934 returned to the method and was followed by Schmidt of Heidelberg.

In my first two cases performed in a sanatorium I followed the method of Graf, and placed a catheter in the space for a few days. In both these cases an external sinus formed and tuberculous pus drained out. In one of these cases the sinus healed, and the man has been back at work for over a year, free from symptoms, with a small residual pneumothorax present. In the other case gomenolised oil was injected into the sinus, and entered the lung through an unsuspected bronchial fistula. The patient died within twenty-four hours. In view of these results I abandoned this technique, and adopted the method of Schmidt, who completely closes the wound.

I propose in this paper to report the 33 cases on whom I have operated in the Brompton Hospital, as the immediate after-treatment has been under my own care, whereas in the cases operated on in sanatoria I have only been responsible for the actual operation.

Technique of Operation.

I have preferred an inhalation anæsthesia with cyclopropane. With this the respiratory movements are at a minimum, and when administered in a closed circuit with a tightly fitting mask the danger of explosion while

using electro-coagulation of vessels is absent. Cyclopropane has an offensive smell and so any leak is easily detected.

The patient is placed in the thoracoplasty position with the upper arm hanging down so that the scapula is well rotated. In this way the vertebral border of the scapula comes to life above and parallel to the fourth rib. An oblique incision, 5 to 6 inches long, is made in the line of the fourth rib, the fibres of the trapezius muscle are divided at right angles to their course and those of the deeper muscles which run parallel to the wound are separated and not cut. Four inches of the fourth rib are now resected subperiosteally. There is less risk of opening the pleura if an incision is not made through the posterior periosteum, but if the intercostal muscles above are carefully divided until the pleura is seen. With the finger the pleura is now carefully detached all round the wound until a sufficient working space has been obtained. No scapula retractor is necessary. Two small double hook retractors hold away the divided muscles. A flexible electric light is now held in the cavity by an assistant while the operator holding the lung down by a small gauze swab on a holder continues the stripping of the pleura under vision by means of another such swab or by a special metal spatula, which has been made for me by the Genito-Urinary Company. Along the posterior ends of the ribs and the bodies of the vertebræ the pleura is usually more adherent, and I prefer here to strip with the finger. Bleeding occurs from vessels in the chest wall, particularly in the neighbourhood of the interval mammary vessels in front and at the posterior ends of the intercostal spaces. Sometimes an intercostal artery or nerve is stripped with the pleura, and requires, if it cannot be again separated from the pleura, to be tied and divided. The bleeding points in the chest wall are carefully coagulated, and great care is taken to leave the walls of the cavity as dry as possible. No coagulation should be done on the pleura itself. It is important that the pleura should be stripped down to the hilum on the mediastinal surface, down to the eighth or ninth rib posteriorly, and anteriorly to at least the fourth or fifth costal cartilage. The wound is closed by a continuous No. 2 chromic catgut suture passing through the edges of the pleura and intercostal muscle, and a second similar suture taking in the muscle of the chest wall. A continuous suture of Japanese silkworm gut closes the skin.

Opening Pleura at Time of Operation.

In two cases the pleura was opened at the time of operation. In neither case did any serious trouble follow, but I think it is a thing to be avoided, as if the opening is large blood will trickle down into the pleura and may

excite a pleural effusion. For this reason if a lower pneumothorax is present it is in my opinion better to allow this to be absorbed before operating, unless it has been present for a considerable time, in which case the pleura will be thickened and not readily torn.

Immediate After-Treatment.

A pneumothorax needle is now inserted just above the wound and a refill 200-400 c.c. of air given until the pressures are just positive. The patient is returned to bed and placed in the sitting position. A second refill is given some six or seven hours later, a third after another twelve hours, and then daily refills for a few days.

A radiogram is taken on the day following operation and about every third day for the next fortnight. The spacing and pressures of subsequent refills are decided by the radiographic appearance and the rate at which the pressure falls between the refills. An attempt is made to keep the pressures at + 14 to + 20. It is very important that the lung should be kept down from the very beginning, as if it expands in the first few hours it may be impossible to obtain a good collapse again. Plate VII : Figs. 6 and 7 show the good effect of increasing the pressures and decreasing the interval between refills.

Immediate Effusion.

All cases show a small fluid level by next day. At first these were left alone, but now as a routine the fluid which is usually pure blood is aspirated, and if it recurs aspiration is repeated at a few days' interval until it no longer recurs. During this time the sitting position is maintained in order that bands of fibrin may not form in the upper part of the cavity, which by their organisation might subsequently draw out the lung.

Post-Operative Complications.

1. *Hæmorrhage.*—(*a*) A slow filling up of the extrapleural space with blood clot. In 2 cases this subsequently liquefied and was aspirated, in 1 case it led to obliteration of the space.

(*b*) Serious delayed hæmorrhage of 50 ounces occurred in 1 case after forty-eight hours, and being unrecognised led to the patient's death.

2. *Late Effusion.*—Two cases developed clear fluid after an interval of three months and four months. After aspiration it did not recur. No tubercle bacilli or other organism were found in the fluid. No case of tuberculous infection has occurred in this series.

3. *Infection.*—In 1 case fluid infected with a streptococcus formed in

PLATE VI

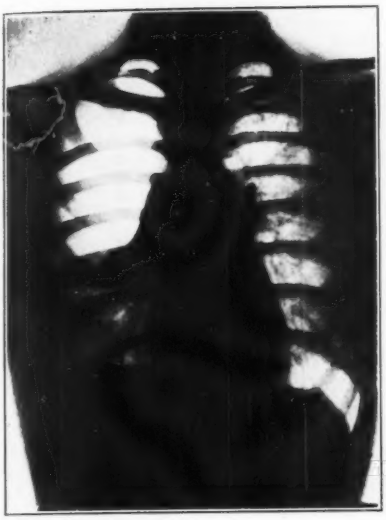

FIG. 1.
Extrapleural A.P. on right. Good selective collapse.

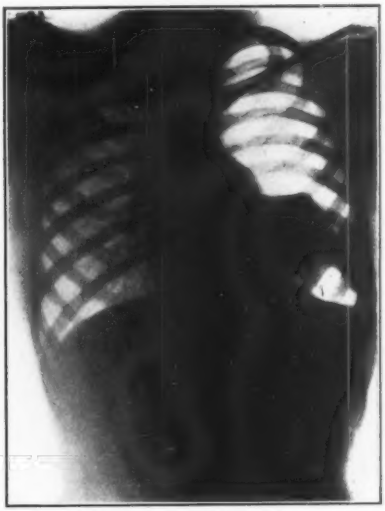

FIG. 2.
Efficient extrapleural A.P. on left.

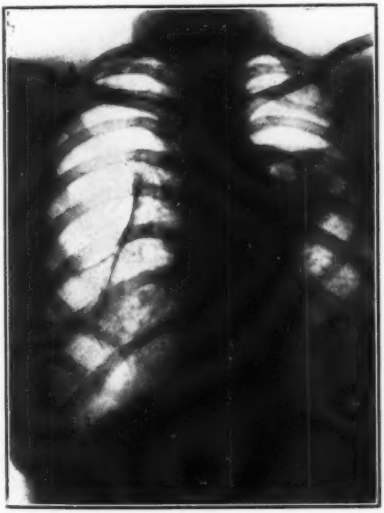

FIG. 3.
Intrapleural A.P. on right. A.P. on left.

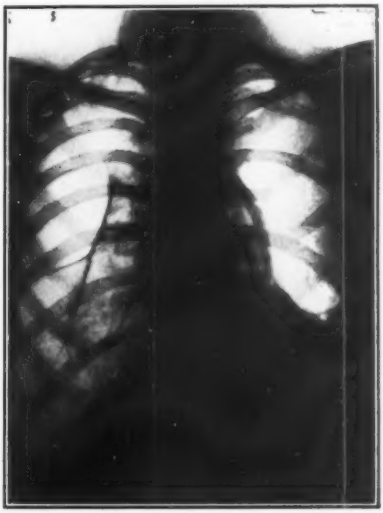

FIG. 4.
Same case six months later after a secondary further stripping of the left lung had been done.

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PLATE VII

FIG. 5.
Small extrapleural A.P. Insufficient stripping anteriorly.

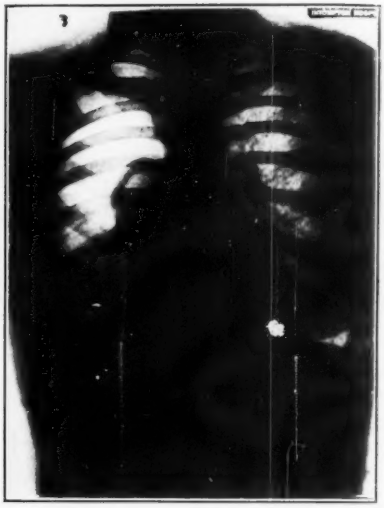

FIG. 6.
Showing cavity still visible with weekly refills.

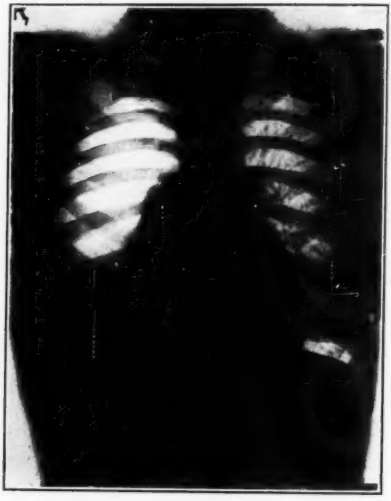

FIG. 7.
Same case, showing cavity obliterated fourteen days later after increase of pressures and refills at three-day intervals.

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the fifth week. Ultimately drainage was performed. Clinically the case is doing well, the pulmonary cavity is closed and the extrapleural space, which still has a tube in, is slowly being obliterated.

4. *Spontaneous Pneumothorax.*—No cases.

5. *Perforation of Cavity.*—No cases.

6. *Emphysema.*—There is always a little subcutaneous emphysema—less on the whole than in thoracoscopy. In 2 cases it extended to the neck, and the patients for forty-eight hours complained of some discomfort in swallowing. Except for these 2 cases, in which it is possible the air entered the neck by way of the mediastinum, mediastinal emphysema did not occur.

7. *Contra-lateral* infiltration present before operation occurred in 2 cases. One died and 1 cleared up.

8. *Tuberculous laryngitis* developed in 1 case, and is now improving.

Double Operation.

In 1 case bilateral extrapleural pneumothorax was performed at two sittings. It was an early case with insufficiently extensive stripping, and though the patient's condition is improved neither cavity has disappeared.

Secondary Operations.

1. In 1 case with a right intrapleural pneumothorax with apical adhesions the original stripping on the left side was inadequate, and six months later a second operation was done and the stripping extended (Plate VI, Figs. 3 and 4). The extrapleural space was found to be lined by a tough, glistening, white membrane 3 mm. thick. No endothelial lining was found on microscopical examination.

2. In another case where a clot had formed a band visible in radiograms, it was thought that it might eventually draw out the lung, so a thoracoscope was introduced, the clot broken up by a metal aspirating tube and removed by suction.

Statistics.

The cases were divided *before operation* into two classes: *Class I.*: Severe cases in poor condition where the operation could only hope to be palliative. *Class II.*: Cases which, though some bilateral, were in good condition, and where there was a reasonable hope of a permanently good result.

Class I.—Three cases.

1. A girl with severe bilateral disease, a constant temperature of 103° or over for two years, and a constant and distressing cough. Left-sided

extrapleural stripping was done. The cough was at once relieved, the temperature remained on a plane 2 degrees lower. The patient was grateful for her relief, which continued until she died, four months later, with extensive intestinal tubercle.

2. A young man with bilateral disease. A good deal improved and still doing well some months later.

3. Died of contralateral broncho-pneumonia.

Class II.—Thirty cases.

Three cases, operation abandoned. Pleura too adherent. Two of these have now had a Semb thoracoplasty.

Two cases died. (1) Hæmorrhage forty-eight hours after operation. (2) At operation a bleeding vessel on subclavian artery could not be controlled. A gauze pack was left *in situ*. A second anæsthetic was given to remove the pack. The patient developed a broncho-pneumonia on other side and died.

Twenty-five cases, clinically doing well. In 18 cases cavity or cavities have disappeared. In 4 cases all recent cavities are diminishing in size. In 3 cases, all early series with insufficient stripping, cavities still present but clinical condition improved.

In the last 16 cases since the technique became standardised and the stripping more extensive there have been no complications. It is during this period that the operation was abandoned in 3 cases. Where the stripping has been adequate, as in these cases, there has been no tendency for obliteration of the extrapleural space to occur, and so an extrapleural oleothorax has not been considered.

It is, of course, too early for any opinion to be expressed as to the final value of the procedure, but so far the results are encouraging.

Indications.

1. In cases where there is reason to believe that after-healing has occurred, re-expansion of the lung may be allowed to take place.

2. In cases where, though permanent collapse is desirable, the condition of the patient as a whole or of the other lung contra-indicates thoracoplasty at that time.

3. In children and young people where thoracoplasty would probably lead to severe scoliosis.

Finally, where permanent collapse is desirable, and the patient is fit for it, an upper thoracoplasty with Semb's extrafascial apicolysis is the operation of choice.

I must acknowledge my debt to the physicians of Brompton Hospital

for the opportunity to operate on their cases and the interest they have taken in them, and to my residents, Mr. R. H. R. Belsey and Mr. W. L. Phillips, for the great care and trouble they have taken in the after-treatment.

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THE ALVEOLAR EPITHELIUM OF THE LUNG

BY S. ROODHOUSE GLOYNE,
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THE view, held for many years, that the pulmonary alveolus of the adult human lung has a continuous epithelial lining playing an intimate part in physiological and pathological processes has recently been seriously questioned. At a Round Table Conference on the subject held by the American Association of Anatomists in 1936 the whole subject was very fully discussed. Since this conference, Barnard and Day (1937) have investigated the problem by means of a study of forty-eight human fœtal lungs of various ages, and have come to the conclusion that although the original tubular spaces have a pseudo-stratified epithelial lining, this lining begins to disappear towards the end of the fifth month of embryonic life and does not reappear. They have also failed to find in fresh fixed tissue the non-nucleated epithelial squames which some of the earlier histologists (*e.g.*, Kölliker) described as part of the lining of the alveoli. Kölliker described two types of cell in the alveolar wall, nucleated polygonal cells occupying the mesh of the capillary wall and non-nucleated thin plates extending over them (*vide* Snow Miller).

Briefly, the following arguments have now been marshalled by the new school against the existence of a complete, intact epithelial lining of the alveolus: (1) Although the existence of an epithelial lining is not doubted in the early months of the fœtal life, during the twenty-first week modifications take place in this lining. The cells composing it exhibit lipoid change in their cytoplasm, their nuclei become vesicular, and loops of capillaries intrude themselves between the cells and displace them (Dwight Palmer, 1936). (2) The epithelial lining thereby becomes discontinuous, though " there is no evidence that all the epithelium disappears " (Bloom, 1936).

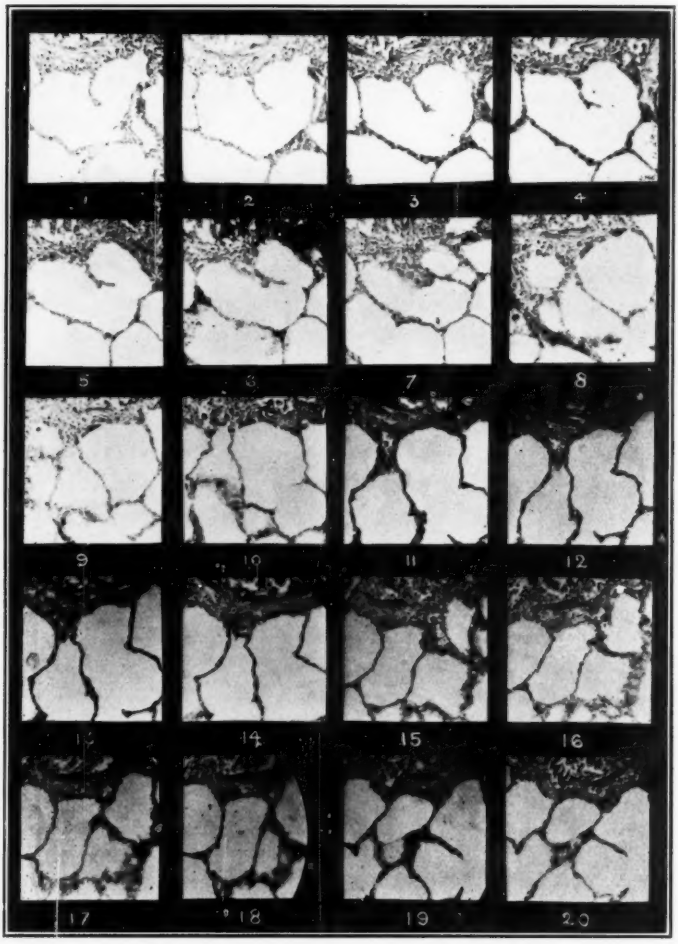
(3) Even this discontinuous arrangement of epithelium only exists, according to Barnard and Day, in the later months of fœtal life, and " in infants which have breathed for any length of time no trace of epithelium can be found." (4) Non-nucleated plates described by Kölliker and the older histologists do not exist (Palmer, Bloom, Barnard, and Day). (5) No epithelium is visible in the alveoli of collapsed lungs in experimental pneumothorax (Bloom). (6) No epithelial lining exists in birds, though it is admitted that it exists in cold-blooded animals (Bloom). (7) The epithelial cell described by the older writers is, in reality, a mesodermal cell derived from the alveolar septum, which becomes prominent in pathological states (Fried, 1936). Mesenchymal cells may, according to Bloom, assume an epithelial arrangement. (8) The constant movement of the pulmonary alveoli would make continuous epithelial lining difficult, if not impossible, to support. Barnard and Day remark that the " alveoli expand and collapse about fifteen times a minute. In no other part of the body is there an epithelial lining contracting and expanding in this manner." (9) A suggestion has been made that " pores " exist in the alveolar lining. This is really a variant of the view of a discontinuous epithelium. But it must be borne in mind that perfusion experiments via the bronchi, on which some of the work is based, are open to serious technical objections.

The supporters of the older school marshal the following arguments in support of the continuous epithelial lining: (1) Lining alveolar cells, though difficult to demonstrate in normal lungs, are evident in pathological states, especially in experimental animals with virus diseases, and these cells do not phagocyte, which fact distinguishes them from mesodermal cells (Sprunt, 1936). (2) The drawings of the alveolar lining depicted in the older textbooks are supported by actual photomicrograms recently published by such a recognised authority as W. Snow Miller, who suggests that the alveolar lining may become separated from the alveolar wall and thereby become more evident as a result of an exudation of tissue fluid beneath. (3) Epithelium is essential to lung repair (Macklin, 1936).

The writer has recently had the opportunity of investigating histologically a human lung from a healthy young adult male who was killed suddenly by a fracture of the skull. Unfortunately, the lung could not be fixed for some hours afterwards, but the histological structure shows clearly in spite of this.

The sections of the lung were cut in a continuous ribbon on a " Cambridge rocker " microtome, each section being 6 to 8 microns thick. The ribbon was cut into portions suitable for mounting on microscope slides and stained with hæmatoxylin in the usual way. A small bronchus, which could be readily identified, running through a long series of the sections was then selected and photomicrograms made of this bronchus and its

PLATE VIII



PHOTOMICROGRAMS OF SERIAL SECTIONS OF NORMAL HUMAN LUNG (×90).

[*To face page* 75

contiguous alveoli in consecutive sections through the series with a one-sixth objective. It is not possible to reproduce more than a short strip of the ribbon thereby produced, but a strip comprising 22 consecutive photomicrograms is shown in Plate VIII, and is a fair sample of the whole. The bronchus is seen just appearing in view at the top of each photomicrogram (in number 6 it is obscured by carbon pigment) and the contiguous alveoli situated below it can be followed, changing in outline as they run through the sections of the strip of ribbon. At no stage is an epithelial lining to the alveolus to be seen. The wall is, in fact, composed of a system of capillaries. At certain points, notably in numbers 8 to 10 and 16 to 19, where the shape of the alveolus changes, the wall appears to thicken. When examined closely with a high power this appearance is found to be produced by two or more capillaries lying side by side. The alveolar wall, indeed, would seem to be formed of capillaries lying side by side in this way with collagenous and elastic fibres interwoven around them, the whole forming a loose basket work with sufficient elasticity to accommodate itself to the respiratory movements.

Admittedly this series of pictures is not conclusive proof, but it is submitted that the series affords yet additional evidence for the view that in the adult human lung there is no complete alveolar lining. This view does not necessarily dispose of the theory of a secretory factor in the mechanism of hæmo-respiratory exchange. The advocates of this theory use the word secretory to mean an active transference of oxygen against the forces of diffusion, through the vital action of the alveolar epithelium (Meakins and Davies, 1925). Such an action, if it exists, may conceivably be carried on by the mesodermal cells which are mobilised with such good effect in certain respiratory diseases such as pulmonary tuberculosis, the pneumonokonioses, and others of non-pyogenic origin. Lastly, the presence or absence of an alveolar lining has an obvious bearing on the pathological interpretation of phenomena such as atelectasis, the absorption of lipiodol, etc.

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EXPLANATION OF PLATE

Photomicrograms of Serial Sections of Alveoli of Normal Human Lung (× 90).

THE TERMINATION OF ARTIFICIAL PNEUMOTHORAX

By GEOFFREY TODD,
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I APPROACH this subject with the greatest trepidation, as I consider our knowledge of when to terminate artificial pneumothorax—both normal and abnormal—still far from complete. (In fact, a prominent chest physician was heard to remark: " Fancy Todd reading a paper on termination of artificial pneumothorax; there must be nothing to say, as we never terminate artificial pneumothorax.") In the circumstances, in view of the great difficulties I am labouring under, I crave the indulgence of my audience, and will endeavour to put forward the views I have formed during the last ten years, both at the Brompton Hospital and King Edward VII. Sanatorium, Midhurst.

Intricately bound up with the time of termination of normal uncomplicated cases must be the type of disease present in the case at its commencement. It has been frequently stated that pneumothorax should be kept up for a minimum period of two years and can generally be terminated within four years. I can assure you this is very misleading. Let us consider the various types of lesion for which (after careful investigation by X-ray) artificial pneumothorax is carried out, and also consider the time of termination, having regard to the nature of the primary lesion. Thus I believe we will expose the patient to the minimum of risk and heighten the chance of permanent arrest despite termination of his pneumothorax.

In the first place we have very early cases with a small amount of infiltration (about the size of a shilling-piece) in one lung, in which the patient is completely symptomless, and which might have remained undiagnosed if repeated winter colds had not led to X-ray investigation. They are admitted to an institution, and, although they have no fever, an almost normal blood sedimentation rate, and have no subjective symptoms, artificial pneumothorax is induced. I think these cases can be allowed to obliterate well within the normal period of two years, as I think most of them would have become quite well without active intervention.

Now we may consider cases which vary in their X-ray appearances and also have a varying degree of subjective symptoms and general toxæmia, and later discuss the question of termination of artificial pneumothorax in each type.

Firstly, cases of fibro-caseous disease, limited to half a lung or so, with no definite evidence of cavitation, with only a small amount of toxæmia causing slight temperature, blood sedimentation-rate round about 20 per cent. and sputum slight in amount but T.B. positive. These cases can be terminated, if all goes well, earlier than those with more extensive disease. The average duration of artificial pneumothorax in this class should, however, be three years at the least.

Secondly, cases of acute broncho-pneumonic disease, accompanied by symptoms of acute general toxæmia, high temperature, high sedimentation-rate and prostration. These will naturally, if the pneumothorax is successful, need a longer treatment than those of the first group. The exact time of termination cannot be stated, as each case will have to be considered strictly according to its progress, but no artificial pneumothorax in this group should be terminated under four years.

Thirdly, cases of thin-walled cavity or cavities, with some infiltration surrounding them, with perhaps slight temperature, raised sedimentation-rate and some or all of the regular symptoms which accompany an active case of pulmonary tuberculosis. These cases should have longer collapse treatment than ordinary cases of infiltration. The artificial pneumothorax will, in most instances, take longer to produce complete collapse of the cavity and thus will need a longer period before termination.

Fourthly, cases of thick-walled cavitation of fairly long standing. In these the lung may take a considerable time to collapse completely, as cauterisation of adhesions or some other ancillary method may be required. I consider that in these cases the artificial pneumothorax should, if possible, be kept up permanently, on account of the grave risks of reopening the cavity, with all its sequelæ.

Having detailed the groups, let us consider the problem in its general principles.

The duration of artificial pneumothorax must be estimated from the time of complete and adequate collapse of the diseased lung area and not from the time of the initial pneumothorax. Also, should symptoms re-appear at any time during the treatment, or cavities reopen, the time of re-expansion must again be altered to date from the re-establishment of complete collapse.

Cases in which the collapse of cavities has been prevented by the presence of adhesions, or which have been complicated by the onset of a pleural effusion, will also require more prolonged treatment than those in which the course of the pneumothorax has been without incident.

Having decided that when complete collapse is achieved pneumothorax treatment is actually commenced, we may now consider what

should guide us to a conclusion regarding the termination of the artificial pneumothorax.

First let me utter a warning that it is not advisable to allow the lung to re-expand about half its extent, at any time during the treatment, in order to ascertain the degree of healing which has taken place. If cavities re-open during the procedure, the previous period of treatment has been wasted. It may be stated as a definite rule that re-expansion should be attempted only after the minimum period of satisfactory collapse is over, when the physician is prepared to accept the result of a possible permanent loss of the pneumothorax.

Re-expansion may be considered when the normal, completely collapsed case has reached what is regarded as a normal period for its type of disease, providing the patient has been completely free from all symptoms for at least nine to twelve months and has a normal blood sedimentation-rate, temperature, etc. Even small departures from health, such as slight fatigue, anorexia, or even menstrual irregularities in women, should give warning that healing may not be complete, and cause one to hesitate to cease treatment.

Now let us discuss complications which may have arisen during treatment, which will hinder re-expansion or make it hazardous.

(1) Excessive formation of fibrous tissue of a tough character, encapsulating the remnants of the tuberculous lesion. These may rupture and cause exacerbation, if the lung is too rapidly allowed to re-expand; or, again, may stop re-expansion altogether.

(2) Pleural effusion, by thickening the visceral pleura, may make it difficult for the lung to re-expand, or cause it to re-expand only partially, one lobe expanding while the other remains semi-collapsed, causing a pocketed pneumothorax.

(3) There are always cases in which the lower lobe may re-expand completely, but the upper lobe, in which fibrosis may have been dense, may lag behind; and thus an apical thoracoplasty will later become necessary, to fill the residual pocket.

Having arrived at a decision to allow re-expansion, the method of its control should be studied. There are three main reasons why the collapsed lung should be made to re-expand slowly.

Firstly, if the lung has been collapsed for a considerable period of time, readjustments have to take place. The pleura covering the lung is often indurated and needs to be stretched slowly, to avoid rupture. Also, the mediastinum will, of necessity, move towards the affected side, and time for the patient to accommodate himself to this should be permitted.

Secondly, it may be found, during the time of termination, that it is

necessary, owing to reactivation of disease or reopening of cavities, to reinduce the pneumothorax, and, in consequence, the lung should not be allowed to reach the thoracic wall until one is sure reactivation will not occur.

Thirdly, all lobes do not re-expand at the same rate. Thus it would be foolish to allow a lower lobe to obliterate quickly if the upper were going to refuse to expand at all. Then we would, as I have mentioned before, be left with a pocket of air, which would require more radical treatment.

It may rightly be said that institutions are always readmitting a certain number of artificial pneumothorax cases whose treatment was begun well but carelessly maintained or prematurely terminated.

How often one hears and reads the advice, " Let the pneumothorax come out," but one is never advised of the method necessary to accomplish the end result. The conditions necessary to accomplish the threefold purpose of causing a slow re-expansion are as varied as the different types of case mentioned earlier. It is quite wrong to cease refills at once, when it has been decided to obliterate an artificial pneumothorax. Air should be introduced at increasing intervals and in smaller amounts, and each time the re-expansion should be controlled by screening. X-ray photographs should be taken at least monthly.

Quite often re-expansion is accompanied by the formation of a sterile effusion, which is often referred to as a " transudate ex vacuo," and is said to be due to high negative pressures, the fluid being an ultra-filtration through the normal pleura. With this I cannot agree, as the fluid contains proteins which could not be filtered through any membranes of the body, and these effusions do not seem to differ in any way from sterile effusions which form during the course of a pneumothorax in which the pressures are not very negative. They should be removed at once and a little air introduced, if necessary; otherwise they may cause irregular obliteration of the artificial pneumothorax, with serious results.

The fields of the re-expanding lung should be carefully scrutinised for any appearance suggesting reactivity, or reopening of a cavity, for which the pneumothorax had been induced. In addition, during the period of re-expansion it is essential for the patient to be under complete control for his general health, and his tolerance to activity should be carefully gauged by exercise tests, a record of morning and evening temperatures and blood sedimentation-rate; and careful enquiry should be made for subjective symptoms, such as increasing lassitude, anorexia, and the return of cough and sputum. If possible, all cases should be treated in a sanatorium, but as this is economically impossible in the majority of cases, they should be looked after by a specialist in a specially selected refill clinic.

If, during re-expansion, the extrapleural pressure becomes too negative, and if re-expansion is causing too much pull upon the diseased lung, or too much displacement of heart and mediastinum, phrenic evulsion should be performed in order to help the obliteration of the air-space.

In all the various types of cases already discussed, termination should not be rushed, but should take on an average three to six months, according to duration of the treatment. One can readily understand that cases of long duration, having refills at intervals of a month or six weeks, will take much longer to re-expand than cases requiring weekly or fortnightly refills to maintain adequate collapse.

Termination of artificial pneumothorax should, if possible, be done in the warmer weather.

When re-expansion is complete, the patient should not increase his exercise for some months, until serial X-ray examination has demonstrated that the diseased area has remained healed and has in no way suffered from the re-expansion.

Before ending the discussion of termination of artificial pneumothorax in normal cases, we must consider patients who have necessarily had their pneumothorax kept up for over six to eight years—for example, for a large thick-walled cavity. In my opinion, these artificial pneumothoraces should be kept up for ever. I do not agree with those authorities who maintain that it is best to do a thoracoplasty in such cases. Time and again one sees much inferior collapse produced by a thoracoplasty for this condition than that produced by the pneumothorax. Why should not the patients continue with the treatment? Most of them are quite well, and can do a full day's work and indulge in healthy games to a moderate extent. I know of some who have had their pneumothorax for over twelve years, and they are all well and at full work. I consider thoracoplasty would be definitely an unnecessary procedure in these cases.

We now come to consideration of abnormal terminations of pneumothorax, enumerating these and considering them separately. They may be determined for the following reasons:

(1) Contra-selective collapse.
(2) Spread of disease to sound lung.
(3) Presence of effusion, which may be—
    (*a*) Simple,
    (*b*) Tuberculous, or
    (*c*) Secondarily infected with other organisms.
(4) Presence of other conditions, such as asthma, excessive emphysema, and prolonged dyspnœa.

1. Contra-Selective Collapse.

In the light of our present knowledge, I consider that in a very few cases this condition necessitates the termination of the pneumothorax. Take, for example, an artificial pneumothorax induced for a large apical cavity, with some infiltration below. It is found after a period, by means of X-ray, that the lower portion of the lung has collapsed but the cavity has remained patent. Cauterisation of adhesions is found to be impossible, owing to a dense adhesion of the whole area to the thoracic wall. Quite a number of people abandon the pneumothorax and then suggest upper thoracoplasty or extrapleural pneumothorax. I think this definitely wrong. The lower pneumothorax should be kept up in both cases. If extrapleural pneumothorax is done, it is carried out in the usual manner, and at the time of the operation, or a month or so later, is placed in communication with the lower pneumothorax. We now have a complete collapse of the whole lung, and can proceed normally. With the thoracoplasty, keeping up the lower pneumothorax helps to prevent spread to the base at the time of operation, and does not increase the risk of spread to the opposite side, as is often averred. Also, it can easily be kept up afterwards, and thus control any disease which may have been present below the cavity, and obviate the necessity of a total thoracoplasty. It is well known that a traumatic effusion develops in the lower pneumothorax during the thoracoplasty, but if this is gas-replaced within two or three days following the operation no harm results to the pneumothorax, and very seldom is it necessary to do more than two replacements before the pneumothorax resumes its normal course and can be controlled so long as is thought to be necessary. When allowing the lower pneumothorax to re-expand in the thoracoplasty case, it cannot be too strongly stressed that all the precautions advocated in normal cases should be carefully carried out. Many a time I have seen a contra-selective artificial pneumothorax abandoned in a hurry for upper thoracoplasty, and within a short time the reactivation of the base has resulted in a further operation, with added risks to the patient, which are in most cases completely unnecessary.

I have not attempted to discuss those cases with multiple adhesions in all zones, which of necessity will have to be abandoned at the earliest possible moment and proceed to complete thoracoplasty.

Too often still we see cases in which a contra-selective collapse in artificial pneumothorax has caused its abandonment, and the patient has been left, the doctor stating that nothing more can be done. These cases may now be given a reasonable chance of permanent arrest, thanks to the work of the thoracic surgeons.

2. Spread of Disease to Sound Lung.

We occasionally find cases in which a pneumothorax has been induced for a great deal of trouble in one lung, which, within a couple of months, spreads to the sound lung. Some people consider the pneumothorax should be abandoned at once, in case too much strain is thrown on the hitherto sound lung, thus interfering with its ability to cope with the recent infiltration. I believe this to be very unsound treatment; and nothing short of a massive spread to the opposite side would convince me of the necessity of abandoning the original pneumothorax. I think it will be agreed that, if the disease in the collapsed lung is allowed to become completely reactivated during obliteration of the artificial pneumothorax, the strain from additional toxæmia, etc., is far greater, not only for the opposite lung but for the general constitution of the patient. In cases where an adequate artificial pneumothorax has been established for fairly widespread active disease on one side, and in which a small spread occurs in the other side, I consider the patient should be kept in bed, at complete rest, and be X-rayed at intervals of a fortnight. Sanocrysin appears to benefit cases with this type of spread to the sound lung. I am not in favour of embarking on a bilateral artificial pneumothorax for cases of spread to the other lung, if they can be controlled by other means. I know of many cases of spread which were treated on the lines described, all of whom regained their normal health without a bilateral artificial pneumothorax, and who still attend us for refills. I am of the opinion, however, that cases of this type which have developed a spread in the other lung should have pneumothorax kept up a great deal longer than would be the case if the other lung had remained sound throughout the earlier treatment. In fact, I would seriously consider leaving the lung indefinitely collapsed, if circumstances permitted it.

(I will now show slides of two cases in which the artificial pneumothorax was abandoned owing to a spread to the sound lung, and I think you will appreciate that in the first one the treatment of the patient was considerably prolonged. In fact, she is still undergoing sanatorium routine treatment, and her sputum has become negative and the blood sedimentation-rate normal only within the last month, after four years. In the second, the outlook is extremely dubious; and the case could only be dealt with by a thoracoplasty, which in all probability would cause an overwhelming flare-up in the spread which occurred in the good lung.)

3. Pleural Effusion.

(*a*) *Simple.*—This should never lead one even to consider abandonment of the artificial pneumothorax. If a brisk reaction takes place at the time of formation of the fluid the patient ought to be kept in bed, and aspiration should not be done until the temperature has been normal for ten to fourteen days, unless the effusion becomes so large that it causes great mechanical displacement of organs, with dyspnœa. Quite often we see a simple effusion in an artificial pneumothorax, which has been aspirated too early, lead to complications which of themselves will necessitate the abandonment of the pneumothorax. When the patient's temperature has returned to normal, if the effusion is large it can be gas-replaced; but small effusions in artificial pneumothorax cases do not do harm if carefully watched on the screen to ensure that they are not causing a part of the collapsed lung to re-expand under the fluid. Should this begin to take place, the fluid should be removed at once, and high pressures should be given, in order to prevent re-expansion. If air fails, gomenol may be tried. The artificial pneumothorax, however, should never be abandoned until all methods of keeping the lung collapsed have failed.

(*b*) *Tuberculous Effusion.*—These cases present a very different problem from the simple effusions. Most effusions containing tubercle bacilli in the fluid eventually become purulent, will continue to thicken up, and will soon cause not only adhering and obliteration of sections of the pneumothorax, but also a steady decline in the health of the patient. They should all be gas-replaced as soon as the temperature has been normal for ten days, and if they re-form, as they almost invariably do, should be gas-replaced at frequent intervals, until they tend to become thick. Pleural washouts should then be started, saline being used for the first three or four times, until one is sure the patient will not have any reaction. Eusol should then be substituted and washouts continued at weekly intervals. By these procedures one hopes to prevent the formation of adhesions and the presence of masses of fibrin, which ultimately cause obliteration of parts of the pneumothorax. It is often said that one should leave a tuberculous pyo-pneumothorax alone, as otherwise one may produce sinuses in the chest wall. If the treatment is carried out in the correct manner, one should not see sinuses nowadays; and one of the great dangers of leaving the fluid alone is that of rupture into the lung, with consequent drowning of the patient or rapid broncho-pneumonic spread over the sound lung. It is equally rare, however, to be able to restore the case to a simple pneumothorax, and most patients will require thoracoplasty. The pleural washouts are given in order to help termination of the artificial pneumothorax by re-

moving thick fibrin from the visceral pleura and promote re-expansion of the lung as far as possible. This will greatly reduce the size of the thoracoplasty, and, if washouts are continued in the residual space after operation, then the collapsed lung will very often obliterate the space entirely. The patient must then be kept under strict sanatorium observation for three to six months, to make sure there is no reactivation in the semi-collapsed lung, which has firmly adhered to the chest wall.

Pleural irrigation and thoracoplasty for tuberculous pyo-pneumothorax has completely altered the prognosis in these cases, and quite a number return to full work within a year of the commencement of the treatment described.

(*c*) *Secondary Infection with Other Organisms.*—These cases are extremely serious, and the fluid which forms must be aspirated daily, in order to control general toxæmia. When the fluid thickens sufficiently, an intercostal, underwater, airtight drain should be inserted, and, when this has controlled the toxæmia, most cases will require a rib resection. As almost all the effusions remain T.B. positive, a residual sinus will be left, and to close this a modified thoracoplasty will be necessary. It is essential, however, not to rush this procedure, but to allow drainage to continue for some months, with irrigation, etc., in order that the patient may be as fit as possible.

(*d*) *Presence of Allied Conditions.*—Quite often one sees pneumothorax done in cases of asthma and in cases of old people with emphysema to a marked degree. Both these conditions contra-indicate the treatment, and these cases should be allowed to re-expand in the ordinary way and then be treated by sanatorium methods. (I am not now talking of those supposed cases of asthma which are in reality tuberculous and respond to artificial pneumothorax, with disappearance of their asthma. They are generally young people, whose X-rays show disease of an active nature limited to one lung. Artificial pneumothorax should be continued for a long period in such cases.)

There are a number of other medical complications, of a rare nature, which would lead one to consider the abandonment of artificial pneumothorax, but I do not think they come within the scope of the subject under discussion.

I have altogether too briefly outlined reasons for the termination or otherwise of artificial pneumothorax, fully realising that on a subject so complicated views will vary greatly. I think, however, that the cardinal points to keep in mind are:

(1) Never cease treatment in less than three years, providing all is well, in the most suitable cases.

(2) See that the patient is controlled adequately during the re-expansion period.

(3) Never cease refills abruptly, but give diminishing amounts of air at increasing intervals, until final obliteration takes place, remembering that, as the lung nears the chest wall, damage from the needle becomes an ever-increasing danger, and this necessitates careful refilling.

(4) Remember also that the commencement of the treatment is from the time of complete and satisfactory collapse, and not from the day of induction.

In conclusion, may I mention that not only before and during artificial pneumothorax therapy, but also during the time of re-expansion, screening and X-rays are of the greatest benefit and cannot safely be omitted at very frequent, regular intervals.

TUBERCULOSIS IN JAMAICA

By EUGENE L. OPIE, M.D.

An investigation of tuberculosis in Jamaica has been in progress since 1928, undertaken by the International Health Division of the Rockefeller Foundation under the auspices of the Medical Service of Jamaica, because the disease is evidently one of the foremost public health problems of this island. It has been considered desirable to learn how tuberculosis spreads in the native population of a tropical country, because the disease is now prevalent and increasing in many parts of the tropics.

The use of Roentgenographic examination and of tuberculin tests makes it possible to define the occurrence of tuberculous infection before it has become manifest disease and to follow the transition of one into the other. This procedure has opened unexplored fields for study of the epidemiology of tuberculosis.

The aims of the investigation have been: (1) To collect information concerning the characters of the disease and the incidence of its various manifestations under the conditions that exist in Jamaica; (2) to determine how the disease spreads and to learn what are the conditions that modify its transmission; (3) while collecting this information, to institute all available procedures that with present knowledge give promise of combating the disease so that the survey may be of current benefit to the health service

of the island; and (4) upon the basis of the information thus acquired, to devise preventive measures adapted to local conditions.

A dispensary for tuberculosis was opened July 2, 1928, and was conducted by Dr. E. J. Saward. At first there were no facilities for radiographic examination of patients, but on January 20, 1931, an X-ray laboratory was established under Dr. C. W. Wells in association with the clinic. The conduct of the dispensary and of the X-ray laboratory has been planned to collect information concerning the occurrence of different forms of tuberculosis, the transition of one into another, and the mode of spread of the disease.

The characters of tuberculosis in Jamaica were described in a paper by Opie and Isaacs (Saward), in large part based upon observations made in the clinic before Roentgenographic examination was applicable to diagnosis of the disease. This study demonstrated that tuberculosis in the negro population of Jamaica often pursued an acute course in young adults with an average length in fatal cases of nine months; of 169 patients with tuberculosis recognised in the dispensary during the first six months of its operation, by symptoms and physical examination, 91, or 53·8 per cent., were known to have died before the end of the second six months.

This rapidly fatal disease has in considerable part the characters of the tuberculosis of infancy and of early childhood in the northern part of North America and in Europe. Tubercle bacilli are eliminated with the sputum in far greater abundance than with the usual chronic disease of white persons.

Tuberculosis in Jamaica spreads rapidly and may be transmitted to others after a brief period of exposure, so that several members of a family may die within a few months. Obvious transmission from one adult to another occurs more frequently than with the tuberculosis of Europe or the United States. The spread of tuberculosis is promoted by the crowding of adults and children into "yard rooms" in the slum districts of Kingston and the larger towns of the island, where an originally agricultural people are maintaining village life under urban conditions. Country people who come into the cities often acquire pulmonary tuberculosis.

The attempt was made to determine the actual extent of tuberculosis in the population of selected areas in Kingston by a house-to-house examination of the entire population of these areas. Dr. C. W. Wells, with the assistance of Dr. H. H. Smith, undertook this survey. The frequency of tuberculous infection as shown by the tuberculin test is as high as that of the largest cities of Europe or the United States. At the age of fifteen years approximately 79 per cent. of children react to tuberculin. The frequency of clinically manifest tuberculosis in the four surveyed districts was as

follows: Smith Village, 1·87; Hannah Town, 1·40; Franklin Town, 0·69; Brentford Road, 0·54. This epidemiological survey shows the high incidence of tuberculosis in the slum districts of Kingston and the relatively low incidence of disease in the more prosperous parts of the city.

A mobile unit began work September 1, 1931, and has been conducted by Dr. E. W. Flahiff. Its purpose has been to collect information concerning tuberculosis in selected places in the parishes outside Kingston, so that the frequency and character of the disease in different parts of the island may be compared. When the results of observations made by the mobile unit in large towns, small towns, and rural areas are assembled, the relatively low incidence of infection and disease in rural districts, when compared with that in large towns or small towns, becomes evident. The frequency of tuberculous infection measured by the tuberculin reaction is less outside of Kingston than that in the city, and is greater in large towns than in small towns, and least in rural areas. At the age of fifteen years, in large towns, approximately 69 per cent. of children are infected, in small towns 48 per cent., and in rural areas 36 per cent. The frequency of clinically manifest tuberculosis in the poorest parts of the large towns of Jamaica with a population of 5,000 to 10,000 was not essentially different from that in the slums of Kingston, and in small towns on the highways the frequency of the disease was approximately the same. In the rural districts of the island, which represent a large proportion of its population, the frequency of tuberculosis, on the contrary, was found to be low, and was less than one-tenth of 1 per cent.

Observations made both in Kingston by Dr. Wells and in the parishes outside by Dr. Flahiff, show that young adults, especially women, are migrating from the rural districts to Kingston and the larger towns. Between the ages of twenty and thirty-nine years, with the peak between twenty and twenty-nine years, women are much more numerous than men in Kingston and in the larger towns; in the same age-group in smaller towns women predominate, but the difference between the sexes is less than in larger towns. In the rural areas, on the contrary, men of this age-group (twenty to thirty-nine years) are more numerous than women. The men, in large part, remain in the rural districts to engage in agricultural work, whereas the young women of corresponding age tend to migrate to the cities and towns in search of employment, chiefly as domestics, seamstresses, and pedlars. In the rural districts young women twenty years of age have, in considerable part, escaped tuberculous infection as indicated by the tuberculin reaction, but in the towns to which they migrate the incidence of the disease in persons of their own age is very high.

It is noteworthy that in persons under twenty years of age the frequency

of tuberculous infection is less in those who have come to Kingston from other parts of the island than in those who have grown up in the city, and increases with the duration of residence there, but after twenty years of age infection has reached high percentages, and differences, though still present, are not significant.

During the progress of the survey undertaken to determine the frequency and character of tuberculosis in Jamaica, the attempt has been made under the auspices of the Government to promote measures directed to the control of the disease. Popular interest in the subject has increased rapidly, and earnest effort has been made to improve procedures for the discovery of the disease, for the segregation of persons likely to spread it, and for the improvement of housing and sanitation in the crowded districts of Kingston and the larger towns.

A travelling X-ray unit presented to the Government by the Jamaica Anti-Tuberculosis League has done much to improve the diagnosis of tuberculosis outside of Kingston, where the only X-ray facilities on the island are available. An X-ray machine is installed within an automobile van; a generator provides electric current so that the machine may be used in places where none is otherwise obtainable. On appointed days this mobile unit operates in association with parish clinics and supplies X-ray films needed for diagnosis.

It is now evident that the chief source of tuberculosis in Jamaica is the city of Kingston, and that the smaller cities are in less degree foci of spread. Housing in the poorer parts of larger towns, such as Spanish Town, Port Antonio, and Montego Bay, is almost identical with that in Kingston, and in the smaller towns and villages along the highways similar conditions exist. Dispensary records show that a considerable part of those who have acquired the disease in Kingston return to their people in the country because, as the result of disability, they are no longer able to support themselves in the city. Nevertheless, conditions for the spread of the disease in rural areas with houses more widely separated are much less favourable, and the disease evidently tends to disappear.

An increasing interest in city housing has been manifested during the past year by active public discussion of the subject, and schemes for improvement of the slum districts of Kingston are under consideration.

In 1933 a comprehensive plan for the control of tuberculosis received the approval of the Superintending Medical Officer, Major T. J. Hallinan, and was adopted by the Legislative Council.

THE CONTROL OF REST AND EXERCISE IN PULMONARY TUBERCULOSIS

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In dealing with the treatment of pulmonary tuberculosis the textbooks generally stress the importance of rest. It appears to me, however, that they attribute to its control by the thermometer a reliability which experience cannot always justify. This paper has been written to emphasise the value of rest, and to discuss the means (with special reference to radiography and blood assessment), by which it can be more scientifically regulated.

Sir Arthur McNalty, in his report of 1932, states that only about 18 per cent. of all cases treated in English residential institutions were discharged with quiescent disease. He mentions "delayed diagnosis, absence of careful selection of cases, and inadequate duration of treatment," as being important causative factors in this unsatisfactory state of affairs. After some years of sanatorium experience I am personally convinced that a stricter application of the rest principle would result in a higher percentage of quiescence on discharge. Rest is usually more thoroughly applied in so-called surgical tuberculosis. In tuberculous disease outside the thorax it is, in fact, more the rule than the exception for general rest to be prescribed until the clinical, and where possible the X-ray, evidence shows that the disease has healed completely. It is true that in many such cases, especially in bone and joint tuberculosis, anatomical considerations may favour the easier acceptance by the patient of a long period of general rest. But, when the disease is localised to the chest, the importance of rest should be just as readily recognised and applied. Failure to do this appears to me to be attributable to several causes:

(*a*) The influence, in so far as English teaching is concerned, of the late Marcus Patterson's theories. His belief that exercise, controlled by temperature and pulse reactions, would increase the patient's resistance by auto-inoculation with his own toxins, is now, I understand, regarded as fallacious, from the immunological point of view. On the practical side sanatorium experience has taught me that temperature and pulse reactions in themselves are inadequate guides to a patient's fitness for exercise.

(*b*) Economic insecurity may so unsettle a patient during his stay in a

sanatorium as to prevent him from adapting himself to his new surroundings or may greatly curtail the desirable period of treatment.

(*c*) Psychological. The patient may fail to adjust himself to his altered environment in spite of the most sympathetic handling and of the provision of suitable occupational therapy. In this regard, I consider that the cultivation of a co-operative spirit among staff and patients is one of the most vital functions of a Medical Superintendent, and that occupational therapy by trained teachers should be an important feature of the régime in every sanatorium, public or private.

(*d*) The inadequacy of the criteria on which the control of rest may be based. To quote, for example, one authority: " . . . As soon as active pulmonary tuberculosis is diagnosed, the patient should be put to bed and kept there for at least a month. Providing the temperature falls to normal, the patient is gradually allowed to sit up in bed . . . subsequently increasing amounts of exercise are taken, a record being kept of the temperature and pulse. If the temperature rises to 99° any evening, the patient should spend the next day in bed."

As mentioned previously, I have found the temperature and pulse insufficiently reliable guides. The placing of too much dependence on them when prescribing exercise has favoured a higher incidence of relapse.

In the accurate assessment of a patient's fitness it is essential to consider the following: Temperature, pulse, radiographic evidence, blood assessment, and last, but not least, the symptomatology, interpreted with due regard to the patient's psychology.

1. *Temperature.*—I prefer a mouth reading to a rectal one, but to avoid missing slight rises the thermometer should be kept in the closed mouth for at least five minutes, preferably for ten minutes in cold weather. In some cases a four-hourly reading may be instructive. Instability with exercise, especially a delay in returning to normal limits, will suggest caution. There is a fairly wide range of normal limits for different individuals and for the same individual under different conditions. Should doubt arise as to the pathological implications of a temperature reading, consideration of all the other available data will help in interpretation. It is extremely rare to find that very slight rises have had any important pathological significance when all the other evidence has suggested the contrary. The patient must be encouraged not to be anxious about minor rises, and not to form a psychologically abnormal attachment to the thermometer.

2. *Pulse Rate.*—Patients with pulse rates within normal limits may be toxæmic, and sometimes patients with raised or unstable rates may have little or no systemic intoxication. The pulse test, as used at Frimley, is of value in sanatorium practice. In apyrexial cases the average resting

pulse rate is taken as normal for the patient. He is sent for a short walk and then rests. The pulse rate is estimated immediately, again in five minutes, and again in half an hour. If a raised rate is due to mechanical cardiac embarrassment, the pulse is usually back to normal within half an hour. If due to toxæmia, the increase in frequency will be more persistent. If the causes of the tachycardia are mechanical, the pulse improves progressively as the heart muscle improves in tone. I have found the pulse test most helpful in some chronic apyrexial cases where the blood sedimentation rate, though fairly stable, remains always slightly or moderately increased. An increased pulse rate due apparently to toxæmic causes will obviously demand a reduction in the patient's activities.

3. *Radiography.*—In 1938 it is hardly necessary to state that this is of much greater value than the stethoscope in indicating fitness for exercise. It is essential, however, that the radiograph should be a good one, taken in conformity with present-day optimal standards, in particular as regards tube-film distance (5-6½ feet), and shortness of exposure ($\frac{1}{20}$ to $\frac{1}{50}$ of a second; if possible, no slower than $\frac{1}{10}$). The appearance of active tuberculosis under these conditions differs materially from that of healed disease. Shadows of new tuberculous formations or the outlines of reactivated old lesions are cloudy, and their margins shade off into the surrounding tissue. With healing, this peripheral indistinctness clears up. Some of the original shadows may disappear. Others become smaller and more compact, leaving discrete, hard-looking nodular formations or fine mottling, or clearly-defined string-like opacities.

The principal limitations of the X-rays in the detection of pathological activity are: (*a*) small changes can take place and pass unrecognised when many shadows are present; (*b*) there may be definite foci of active disease behind the heart. Even with lateral or oblique views it may in some of these cases be difficult radiologically to determine activity or degrees of it; (*c*) foci of active disease may occasionally exist in calcified areas. In a case where a patient is left with a cavity, in which there may be a sputum level, but the walls of which are hard and fibrous, the radiological findings may not indicate a serious limitation of the patient's activities. These would have to be regulated according to the degree of systemic disturbance, if any.

Although my experience of stereo-radiography is extremely limited, I can well imagine that in some cases it may be superior to ordinary radiography in the assessment of pathological activity.

Tomography, or sectional radiography, which has been commercially available for the past three years, can help in this determination. Although the time exposure of the film in tomography is much longer than in ordinary

radiography, this is compensated for in some measure by a clearer representation of the lesions, owing to the abolition of superimposed shadows, and by the use of a Potter-Bucky diaphragm. Further, tomography, by preserving the fine detail in each section represented, is greatly superior to the use of hard rays in the elucidation of the underlying pathology in relatively opaque areas. In so far as lack of distortion and sharpness of image are concerned, the best results in tomography are given by those apparatuses which permit of a 5-foot tube-film distance and the taking of sections of lung tissue as thin as 3-4 millimetres. Tomography alone among radiographic methods will reveal the true nature of some pulmonary lesions. In sanatorium practice, in connection with the correlation of X-ray evidence and the prescription of rest and exercise, I have found tomography most helpful in the upper lung fields (owing to the elimination of clavicle and rib shadows) and in the presence of pleural thickening.

It is always necessary to spend adequate time in the examination of X-ray films. The films should be viewed both in close proximity to the negatoscope and from a distance of about 6 to 10 feet. Sketching the X-ray appearances into the patient's notes will prevent details from being overlooked and serve to fix the picture in one's memory.

4. *The Blood Sedimentation Rate.*—For the past ten years I have included this test in the routine examinations of patients. In the majority of cases it is done once a fortnight. I have found that regular estimations of the blood sedimentation rate (S.R.) reflect reasonably faithfully the progress of the disease.

I have always used the Westergren method, which is most in favour on the Continent. Readings of the drop in mm. in the 200 mm. vertical tube are taken at the end of the first and second hours. Under the conditions in which the test is carried out here a reading of 4 or less in the first hour is regarded as normal for men, and one of 6 or less for women. (Very occasionally the drop in the second hour may be out of all proportion to the drop in the first hour, and, if so, this should be taken into consideration.)

An increase in the rate commonly occurs simultaneously with or following fresh pathological activity. Very exceptionally the rate rises before symptoms, temperature, pulse rate, X-rays or physical examination indicate an exacerbation or spread of the disease. The S.R. usually settles to normal later than the temperature or pulse. In the great majority of cases changes in the S.R. bear a direct relationship to the radiological findings. A persistent increase, which may be slight or moderate, should, in the absence of evidence implicating the chest, lead to a search for some cause other than the pulmonary lesion.

Illustrative Case.—A man with a pneumothorax, which symptomatically

and radiologically controlled the pulmonary disease, had a persistent slight increase of the S.R. (the most favourable reading was 10 in the first hour, 30 in the second). Opinions differed regarding the condition of his tonsils. It was finally decided to have them enucleated. Following the enucleation, the S.R. gradually improved and became stabilised at a normal level on the highest grades of walking exercise.

In advanced cachectic cases the rate tends to become slower, so that it bears no direct relationship to the gravity of the patient's condition. Likewise, in the early stages of such exudative processes as pleurisy, the rate may be grossly exaggerated. Isolated readings, therefore, may not reflect accurately the real condition of the patient, and the S.R. must always be considered in relation to the whole clinical picture. A series of estimations done under standard conditions over a period of weeks and months will provide most valuable information. As a general rule, patients with increased rates tend to relapse more frequently than those with persistently low rates—and the higher the rate the greater the tendency to relapse.

I believe that the S.R. is one of the most dependable single factors of assessment at our disposal. On the other hand, since it is influenced by conditions other than the absorption into the blood of broken-down disease products, its dependability is not absolute. The rate may be altered by menstruation, as a result of injections of gold, tuberculin, or vaccines, in pneumothorax treatment until the disease is under control, or, if effusions appear, during oleothorax, and by complications, intercurrent infections, or surgical interventions. Variations due to errors in technique (syringes and needles not cleared of spirit or ether, insufficiently dried tubes, etc.) or to differences of room temperature of more than 6° F. should not be allowed to occur. Appreciable changes attributed to the process of digestion may occur in patients whose S.R. is already markedly increased. (Such changes, however, can be discounted in sanatorium practice, since firstly the test should be done under standard conditions and secondly the rate before the ingestion of food, as well as the other clinical data, will already have indicated some limitation of the patient's activities.)

For several years past I have found the information provided by regular S.R. estimations of great value in the grading of exercise. *For patients who appear to have a reasonable hope of securing arrest of the disease*, I usually do not prescribe graduated exercise out of doors until the S.R. is normal or nearly so.

First-hour readings of between normal and 20, or even higher, are frequently met with when the temperature and pulse do not indicate any definite systemic disturbance. Such rates are not uncommonly found in chronic cases, particularly in middle life. These findings do not of them-

selves demand serious attention if the radiographic appearances do not suggest recent formations of tubercles or perifocal inflammation, and if the temperature and pulse rates are stabilised at normal levels on exercise.

If there has been recent activity, I usually prescribe rest until the S.R. is stabilised at a satisfactory level, which in a chronic case as just mentioned may be well above normal. It is, in fact, especially where there has been recent activity, but with the temperature and pulse rates within normal limits, that I have found attention to the S.R. most helpful. To increase the patient's exercise before the S.R. has settled may precipitate a relapse.

Instability of the S.R. should be as carefully considered as instability of the temperature or pulse rate, with which it may or may not be associated. A slightly increased rate in combination with a doubtful pulse test or exercise temperature reaction, or both, should strongly urge caution in prescribing exercise even in the presence of indefinite radiological evidence of pathological activity. If the S.R. is normal, exercise can as a rule be confidently increased. There are very occasional exceptions to this.

A young male patient with a history of pleurisy with effusion some two months previously was admitted with signs of thickening of the pleura on the right side, with very slight upper-zone infiltration of the lung. He was free from symptoms. His temperature reactions were well within normal limits. The pulse rate was usually in the 80's at rest. His S.R. was 3 in the first hour and 7 in the second hour. His exercise was gradually increased until he was walking up to 1½ miles twice daily and getting up for the two principal meals. He was gaining weight and was apparently doing well. Suddenly he developed a slight rise of temperature and pulse rate, and within a few days fluid had reformed at the right base. Gas replacement was done in an attempt to collapse the infiltrated region of the lung, but refills were abandoned owing to extensive adhesions. The temperature became stabilised at a normal level in six to seven weeks; the pulse took about two months to settle to the 80's at rest, and the S.R. in three months was down to 2 first hour and 6 second hour. The patient then began to move about, and subsequently he went steadily ahead without further relapse. The sedimentation rate settled to 1 in the first hour and 2 in the second hour.

It is in some of these cases that help may be obtained from a study of the leucocytes.

5. The importance of the polymorph-lymphocyte-monocyte ratio and of the polymorph lobe count (Von Bonsdorff, Arneth, Schilling, etc.) in reflecting the underlying pathological condition has been confirmed by many investigators. The practical objections to these tests for routine use are that they require special experience and uniform interpretation

to secure consistently accurate results, that they are time-consuming, and that sometimes they are too sensitive an index of the pathological state. In sanatorium practice such objections are hardly valid, and at times these tests will undoubtedly provide valuable supplementary information. In some continental clinics surgical interventions, such as thoracoplasty, are carried out, if possible, only when the polymorph-lymphocyte-monocyte ratio is in a favourable phase—*i.e.*, showing a relative increase of lymphocytes.

In a convalescent tuberculous patient, with no intercurrent complications, if a good S.R. is associated with a persistently poor p.-l.-m. ratio and with a definite shift to the left of the lobe count, I should proceed cautiously when increasing his activities. I should keep the symptomatology and the temperature and pulse reactions under especially close observation, particularly if the radiographic information was indefinite. The patient who relapsed with pleurisy with effusion had, when first under treatment, only 19 per cent. lymphocytes and a definite shift to the left of the Von Bonsdorff. After the three months' rest following his relapse his lymphocytes increased to 42 per cent. and his Von Bonsdorff went to within normal limits. At the time tomography was not available, and, owing to the thickening of the pleura and the superimposition of the shadows of the ribs and clavicle, it was difficult radiologically to assess the activity of the pulmonary infiltration. In this case the deficiency of lymphocytes and the shift to the left of the Von Bonsdorff were the only definitely abnormal factors in his assessment.

On the other hand, when the S.R., p.-l.-m. ratio and lobe count are all very satisfactory, I feel I can confidently prescribe an increase of activities, especially if these favourable findings are supported by the other clinical data as is usually the case.

Since they each represent a different phase in the body's reaction to the disease, I prefer to know the individual details of the S.R., p.-l.-m. ratio and the Von Bonsdorff rather than to express them in some single mathematical formula such as the Houghton Index.

I have not found estimations of the vital capacity of any special help in the prescription of rest and exercise. A diminution in the vital capacity may be due to toxæmia, which will be revealed always by some or all of the other methods above referred to, or it may be due to mechanical causes such as fibrosis, or to both. A patient with a reduced vital capacity as a result of mechanical causes will automatically limit at least the pace, if not the extent, of his activities.

6. *Symptomatology.*—This obviously plays a very important part in the control of rest and exercise. Acquaintance with the psychology of the patient and the information provided by the temperature, pulse, X-rays

and blood will in every case permit of a more accurate interpretation of the symptoms. The appearance of fresh symptoms or the exacerbation of existing ones requires immediately a re-assessment of the case, and, if the patient is on exercise, demands invariably a limitation of his activities.

Conclusion.

No single method will estimate infallibly the degree of pathological activity. Each has its limitations. Sanatorium experience shows the necessity of correlating all the available information and of considering it in reference to the patient as an individual.

Though exercise is of great importance in the treatment of pulmonary tuberculosis, particularly in restoring muscular tone and self-confidence, it should not be prescribed prematurely. Further, if disappointments are to be avoided, it must be controlled by all available means. In this paper these means have been discussed, with special reference to the X-ray appearances and to the blood assessment.

AIR EMBOLISM COMPLICATING ARTIFICIAL PNEUMOTHORAX

(DESCRIBING A NEW AUTOMATIC PNEUMOTHORAX APPARATUS)

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Some months ago there appeared in this Journal a paper by Myers, Levine, and Leggett (1937, xxxi., p. 77), in which two dangerous complications liable to occur in artificial pneumothorax, namely air embolism and spontaneous pneumothorax, are discussed at length in the light of abundant material taken from outside sources and from the authors' own experience.

Fortunately air embolism is only a rare accident in artificial pneumothorax. Forlanini, who introduced this therapy, reports 12 accidents in 10,000 cases of intervention. The statements of other authors are

likewise in the neighbourhood of 1 per cent. Deviations from this figure can be accounted for in various ways. In the first place it is not easy to interpret rightly the symptoms of air embolism involving slight quantities of air, more particularly seeing that fainting or nausea may be incited, in vaso-liable patients, by the mere insertion of the needle. And then the complications due to air embolism are often only of a transient nature, for which reason these cases are certainly too often attributed to shock (pleural shock, and so forth). Even though pneumothorax therapy is attended by these complications in so very small a proportion of cases the question must be asked whether or not they could be avoided.

Air embolism in pneumothorax is due, of course, to air entering pulmonary veins. According to Schlaepfer, the pathologically altered lung is more endangered in this respect than the normal lung, since in the former, owing to induration and adhesion, the contractibility of the vessels is impaired. It is thus conceivable that gas might be aspirated at a damaged part of the lung remote from the point of insufflation of the artificially introduced air. Practically speaking, the case in which the pneumothorax needle itself injures a pulmonary vein and lets air directly into the vessel is of greater importance.

From what has been said, it follows that the danger of gas embolus is particularly great at indurated points, since the fixed lung is only too easily injured by the needle, and, being prevented by the callosity from collapsing, is bound to remain in close contact with the canula. The only criterion for the proper positioning of the needle orifice in the pleural cavity gap is furnished by accurate and close observation of the manometer reading.

Forlanini was right, therefore, when he said, a quarter of a century ago, that air embolism should be of historical interest only.

In the pleural cavity there is reduced pressure which is greater at inspiration than at expiration. Since mercury manometers give but very slight differences of reading, it is advisable, where the readings are to be observed rather than recorded, to use the water manometer. It is the accepted practice to measure the pressure in the pleural cavity in centimetres of water column, and either to give the extreme values at maximum inspiration and maximum expiration or the arithmetical mean of these two figures. Measurements repeated in the course of filling show that the pressure rises while at the same time the difference between the pressure at inspiration and that at expiration becomes less during filling. It thus also follows that at refills the manometer must normally give smaller deflections.

Apart from the absolute level of the readings the promptness with which the pressure gauge plays up and down is of importance, since given proper

positioning of the needle the deflections of the manometer must take place synchronously with the movements of breathing. Stationary manometer readings may have various causes: (1) The needle orifice is in the chest wall, (2) in a callosity, (3) in a body of fluid, (4) the water used in sterilising the needle and tube was not completely removed, (5) the needle is clogged with a clot of blood or particles of tissue.

Very slight deflections of the manometer may be attributed to the following causes: (1) The needle has penetrated into the lung, (2) tissue is situated immediately in front of the needle orifice, (3) partial presence of one of the above-enumerated circumstances causing stationary manometer readings.

A feature we cannot afford to ignore is the so-called " climbing " of the manometer—that is to say, steady rising of the liquid in the limb of the manometer communicating with the pleural gap, with the absence of respiratory fluctuations. Although this type of behaviour on the part of the manometer may not be taken as proving the existence of communication between the needle orifice and a pulmonary vein, since a detached or semi-detached flap of tissue situated in front of the needle orifice is capable of acting like a valve, yet it may be stated as a general rule that a climbing manometer reading is a danger signal of the first order.

Manometer control affords the *only* means of avoiding air embolism. It is therefore essential to be able to observe the intrapleural pressure at all stages in the application of a pneumothorax. Attempts have been made theoretically and practically to settle the question of whether and under what circumstances it might also be possible *during* the filling to utilise the manometer for ascertaining the proper positioning of the needle. The basic theoretical considerations are as follows: If liquid is allowed to flow out of a vessel through a horizontal tube (see Fig. 1 [I]) the pressure prevailing at different points in this tube is represented by the height of the column of liquid in vertical branches at these points (horizontal shading). Provided the horizontal outflow tube has the same bore throughout, the levels of the liquid in the vertical branches will all be different as long as the liquid is flowing out, but will be disposed in an inclined straight line joining the level of the liquid in the vessel and the orifice of the outflow tube. As soon, however, as the outlet orifice is closed the liquid rises in the vertical branches to the extent of the vertical shading, namely to a common level (law of communicating vessels). It will readily be understood that closure of the outlet orifice is indicated much more conspicuously by the sudden rising of the liquid in one of the vertical branches than by the fact that the level of the liquid in a large vessel ceases to fall.

On this principle may be based the ascertainment of a closure of the

pneumothorax needle *during* the filling. Fig. 1 (II) represents diagrammatically the manometer communicating with the pleural gap, and giving a certain initial reading owing to the suction exerted from the pleural cavity (suction indicated by a wavy arrow). This is the conventional method of measuring the pressure in the pleural cavity. Fig. 1 (III) represents the filling operation with the interposition of a manometer. Air under pressure flows from the round flask in the direction of the straight arrows and counteracts the suction exerted from the pleural cavity, with the result that the liquid in the manometer assumes another level. This

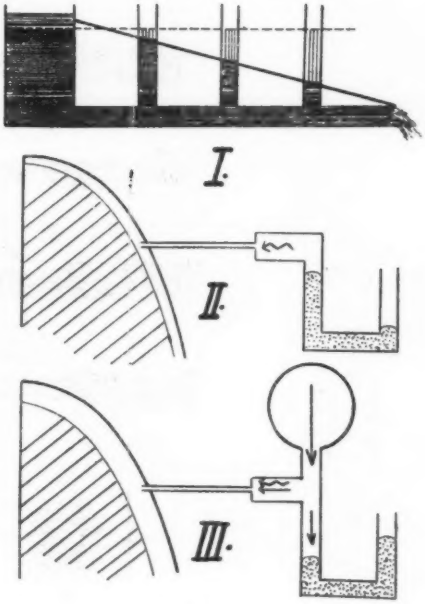

FIG. 1.

new level does not change as long as the air can flow out unchecked, provided the remaining factors (pressure and suction) remain the same. Obstruction of the needle, or even mere checking of the free outflow therefrom, immediately causes the liquid in the free limb of the manometer to rise suddenly.

Practical tests have shown that this manner of interposing the manometer (flow manometer) is very useful, and indicates obstruction of the needle instantly. Incidentally, the pressure fluctuations in the pleural cavity, due to inspiration and expiration during filling, are also manifested in the

manometer readings, the deflections amounting, however, to only about 2 to 3 cm.

Now I have set myself the task of designing a pneumothorax apparatus which allows of continuous manometer control, automatically signalises any exceeding of the desired pressure and closure of the needle, admits of blowing in air under low pressure, and, in addition, is simple and easy to use.

My apparatus consists of two superposed glass vessels which are stationary (Fig. 2, Plate IX, Figs. 4, 5). The upper of these vessels is a graduated

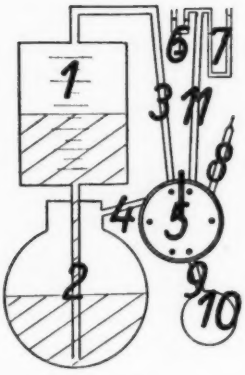

FIG. 2.

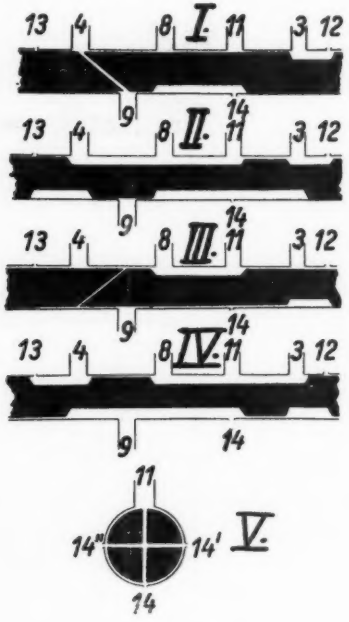

FIG. 3.

cylinder 1 and the lower a flask 2. Each of these containers is connected by a tube (3, 4, respectively) with a multi-way cock 5. This cock in its turn is connected, by means of the tube 11, to two manometers 6 and 7, which are connected in parallel to each other, to the needle tube 8, and through the filling tube 9 to the pumping device 10.

The mode of operation is as follows: By means of the rubber-ball pump, air is forced into the flask displacing the water or sublimate solution (indicated by shading) into the cylinder (Fig. 2). On application of the pneumothorax the liquid sinking from the cylinder into the flask drives the air

PLATE IX

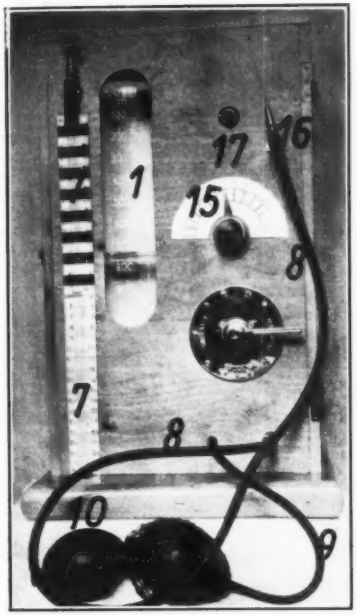

FIG. 4.

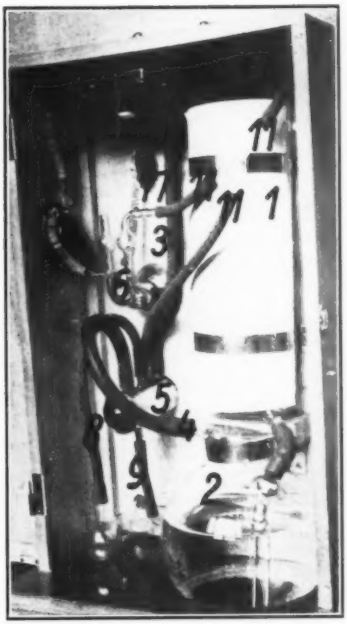

FIG. 5.

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out of the lower vessel into the pleural cavity. This operation is represented in Fig. 2. At the same time the lowering of the level of the liquid produces in the emptied portion of the cylinder a partial vacuum which may be used to withdraw air again from the pleural cavity.

Having thus outlined the lay-out of the apparatus, I will deal with its characteristic features in detail, beginning with the multi-way cock (Fig. 3 [I-V]). This multi-way cock takes the place of all the cocks used in other types of apparatus, and admits of four settings corresponding to the following operations: (I) Filling the apparatus with air; (II) blowing air into the pleural cavity; (III) measuring the pressure in the pleural cavity; (IV) withdrawing air from the pleural cavity. This multi-way cock is operable with one hand, and owing to the provision of feelable marks (denoted by dots in diagrammatic Fig. 2) is operable *in the dark* (*i.e.*, does not need looking at). Fig. 3 shows the different phases or settings of the cock, the reference numbers being in conformity with those in Fig. 2. The front disc of the cock is comparable to the dial of a clock. The " 9 o'clock " position of the handle working the plug then represents phase " I," in which the apparatus is charged with air. From the filling tube 9, to which the pumping device is attached, air flows through the sloping port in the cock plug and the delivery pipe 4 into the flask from which, as already mentioned, water is thereby displaced into the cylinder. The air displaced from the cylinder in this operation escapes through the suction pipe 3 and the outlet 12 into the open. Turning the handle of the cock through a right angle into the " 12 o'clock " position institutes phase " II " for blowing air into the pleural cavity. The delivery pipe 4 is connected with the needle tube 8 and with the manometer tube 11, while the suction pipe 3 communicates with the outside atmosphere as in phase " I." The falling column of water then drives the air from the flask into the delivery pipe, thence into the needle tube, and thus into the pleural cavity. Through the suction pipe 3 air is aspirated from 12 into the cylinder; otherwise of course the level of the water in the upper vessel could not fall. The purpose and significance of the connecting-in of the manometer tube in this phase have already been discussed above. Phase " III " (with the handle in the " 3 o'clock " position) serves for measuring the pressure in the pleural cavity. At this setting the needle tube 8, manometer tube 11, and suction pipe 3 are interconnected, while the delivery pipe 4 communicates through 13 with the outside atmosphere. The pipe 3 then draws air out of 8 (and thus out of the pleural cavity) into the cylinder, again of course in response to falling of the level of the water. The air displaced from the flask by the liquid escapes into the open through the pipe 4 and the outlet 13.

The last diagram (V) of Fig. 3 is a transverse section of the cock plug in the "10.30 o'clock," "1.30 o'clock," "4.30 o'clock," and "7.30 o'clock" positions. In these intermediate settings of the multi-way cock there is automatic setting of the manometer to zero, in that the manometer then communicates with the outside atmosphere through three apertures 14, 14′, and 14″ at once.

Diagram II in Fig. 3 is somewhat out of conformity with the actual conditions, since 3, 8, and 11 are by no means brought into connection with each other quite simultaneously. By virtue of the peculiar design of the cock plug, 8 and 11 are first connected together, so that at the beginning of position "II," irrespective of whether this position is approached in a clockwise direction or in the other direction, a position similar to that of phase "III" is temporarily assumed. These two settings imitating phase "III" are denoted by the two dots on either side of the "12 o'clock" position in Fig. 2. It is only when the handle is in the intermediate position between these two marks that the conditions shown in Fig. 3 (II) are established. This ensures positively that every filling is pressureless at the start.

From Figs 3 (I) to 3 (IV) it will be also seen that during the phases "II" to "IV" the air-pumping device (9, 10) is cut off from communication with the rest of the apparatus. It is thus rendered impossible for air to be pumped directly from the pumping device into the pleural cavity.

A further result of the peculiar design of the cock is that the air flows out of the apparatus under low pressure. This is so for the reason that both in filling and in withdrawing the falling column of water is, as it were, checked from above and at the same time supported from beneath, since in phase "II" this column of water has to overcome not only the friction involved in the path 8 to 4, but also that involved in the path 3 to 12.

The four positions or settings of the cock are clearly marked and named to avoid mistakes and for ease in use.

From Fig 3 (I) it will also be seen that when refilling with air the needle tube need not be pinch-sealed, since 8 is automatically cut off from air supply during this phase.

Fig. 2 also shows the manner of connecting in the manometer. A water manometer and a mercury manometer are connected together in parallel. The water manometer (7) serves for the subjective reading-off of the intrapleural pressure, while the mercury manometer (6) serves for objective registration. The mercury closes a contact to ring a bell when a certain pressure limit is reached. This limit may be pre-determined with the aid of a set-screw (not denoted in Fig. 2, and denoted by 15 in Plate IX, Fig. 4), the adjustment being accurate to a centimetre of water column.

There remain a few improvements of detail to be mentioned. A needle holder 16, on the front wall of the apparatus, enables the needle to be suspended in such a manner as to remain sterilised. The glass vessels are, as far as possible, enclosed (Plate IX, Figs. 4 and 5). The signalling device is capable of being switched off by means of a switch (denoted by 17 in Plate IX, Fig. 4).

The apparatus is used as follows: The rubber-ball pump is connected up to the exposed glass nozzle, the cock set to "*blow*" (I), and the pump actuated until the liquid rising in the cylinder reaches the zero mark. The cock is then set to "*manometer*" (III) and the application of the pneumothorax may begin. If the manometer shows the normal fluctuations, the cock is set to "*pneu*" (II). When the handle coincides with the stud next to the word "*pneu,*" air is aspirated into the pleural cavity from the manometer free of pressure. The handle of the cock is then moved slightly beyond the stud and the filling starts. The marks on the cock enable fine regulation of the air-stream to be achieved. For the purpose of automatic signalling the pointer is set at "6" or "8" for ordinary fillings. A signal is then given when the pressure limit is exceeded, indicating closure of the needle. The setting marked "*suck*" serves for withdrawing air from the pleural cavity.

Summary.

Air embolism as a complication in pneumothorax is almost always avoidable.

Since manometer control affords the surest means of safeguarding against gas embolism, pressure fluctuation during the filling is analysed and the conditions governing detection of needle closure discussed. A new pneumothorax apparatus is described which is based on these considerations, and which has the following features:

All the cocks used in conventional types of pneumothorax apparatus are replaced in this new apparatus by one single multi-way cock. This cock has four different settings, one for each of the following operations: (*a*) Filling the apparatus with air; (*b*) blowing air into the pleural cavity; (*c*) measuring the pressure in the pleural cavity; (*d*) withdrawing air from the pleural cavity. This multi-way cock is operable with one hand, and, owing to its feelable marks, in the dark—*i.e.*, without looking.

One and the same manometer is kept constantly in communication with the needle tube, whereby on the one hand the absolute pressure is measured, and on the other hand a closure of the needle passage is at once detected.

Exceeding of a predetermined pressure limit is automatically indicated by a bell signal, so that there is no possibility of overlooking a needle closure. The size of the vessels used is the same as in the usual rigid types of apparatus, but there is double the quantity of air (1,000 c.c.) immediately available.

On refilling the apparatus with air it is not necessary to clamp the needle tube. When the apparatus is set to the working positions the air-pumping device is permanently cut off from the rest of the apparatus, so that it is impossible for air to be forced into the pleural cavity directly from the pump or under the high pressure set up by the pump. By the braking action exerted upon the inflowing and outflowing air in the cock, with the aid of marks on the cock, the rate of air-flow can be very accurately regulated, while owing to the high internal friction in the cock the air flows out of the cock under low pressure but slightly influenced, practically speaking, by the actual head of water in the apparatus.

Each filling is begun without any excess pressure, solely by virtue of the aspirating power of the pleural cavity.

All the settings of the cock are clearly marked and named.

On transition from any one setting of the cock to any other setting the manometer is automatically adjusted to zero. Only one limb of the manometer is visible, to avoid mistakes. The pressure limit at which the signal is to be given can be accurately set on a scale.

The needle can be clamped in a needle holder so as to remain sterile. All glass parts are as far as possible enclosed, and are yet readily accessible for cleaning purposes through a door at the back of the apparatus.

THE BLOOD INDEX IN PULMONARY TUBERCULOSIS IN WOMEN

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Houghton (1932) has devised a blood index depending on the sedimentation rate, the Von Bonsdorff count, and the polymorph-lymphocyte-monocyte ratio for use in pulmonary tuberculosis, and the application of this index was confined wholly to men. No observations, as yet, seem to have been put forward when this index has been applied to women. This index was

used over a period of nine months at the County Sanatorium, Milford, in females varying in age from sixteen to forty-nine years. Twelve patients who took their discharge from sanatorium before three readings were obtained have been excluded. Moller and Barton (1933) modified this index by using the Schilling division of the neutrophils instead of using the Von Bonsdorff count, owing to the length of time it took to obtain the count. The Von Bonsdorff count, however, can be made at the same time as the differential count.

Technique.

The technique was similar to that described by Houghton, for each reading 2 c.c. of blood being taken from a vein in the ante-cubital fossa. Blood samples were obtained at 9.30 a.m., one hour after breakfast; this was the only divergence from the method advocated by Houghton, who obtained his blood samples at noon. The Westergren method was used for obtaining the sedimentation rate, readings being taken at one hour, two hours, and twenty-four hours. The one-hour reading only was used in obtaining the index. Specimens of blood were taken on admission, one month later, and every two months after this. In the first 49 cases specimens were taken when the patient was menstruating, in the pre-menstrual stage, or when she had completed her period. In the second 43 cases care was ascertained that the patient had completed her menstrual period.

Prognosis.

Out of the 80 cases taken for consideration 56, or 70 per cent., gave results the summation of which pointed to an immediate prognosis similar to that assessed from the clinical, radiographic, and laboratory findings. The remaining 24 cases (30 per cent.) had such divergent readings that they were of no use in formulating a prognosis. Of these 24 cases, 13 cases (16 per cent.) showed marked variation during the menstrual stage, and this will be referred to later. Of the remaining 11 cases (13 per cent.) no reason for the inconsistence in the readings could be found. In 10 of these cases the index fell, but the patients continued to improve clinically, and, in fact, 2 were discharged from sanatorium as quiescent. After eight months, 1 case is slightly improved, 1 is much improved, and 3 cases show no change. Four cases are now quiescent, and only 1 is worse. In these 10 cases, there appeared to be a high sedimentation rate with a low lymphocyte count. In one case, however, the index rose considerably from twenty-nine to one hundred and five, and two months later had dropped to three. She had

gross disease with evening pyrexia of 100° F. The extent of her disease may have been the cause of this freak rise.

In 30 cases, or 37·5 per cent. of the total number of cases, a depression in the index occurred, the reason of which was shown at a later date. In 10 per cent. of these cases the depression was due to hæmoptysis, in 74 per cent. it was due to a spread of disease, and in 16 per cent. due to fluid occurring in an artificial pneumothorax. It is interesting to note that the blood index always appears to rise the month following the patient's admission to sanatorium, during which period she was confined completely to bed, a point emphasised by Houghton in his series with men.

The Effect of the Menstrual Period.

Marked variations in the blood index were found to occur during the pre-menstrual stage and the menstrual period. In 3 cases the index rose unexpectedly and considerably, in 6 cases it fell, and in 4 cases the index both rose and fell when taken on different occasions during these periods. In all these cases there was no agreement with the clinical condition of the patient at the time that the blood was taken, or at a later date. The sedimentation of the red blood cells is known to be accelerated during menstruation, but no reference has been made to the irregular rise and fall of the blood index which may occur in the pre-menstrual stage and the menstrual period.

Summary and Conclusions.

Houghton's blood index has been investigated in 80 female patients. In 70 per cent. of these cases the immediate prognosis given by a series of blood indices was found to be of use. In 37 per cent. of cases a lowered index indicated an unforeseen change in the patient's condition which occurred at a later date—*i.e.*, hæmoptysis, spread of disease and fluid in an artificial pneumothorax. A sudden fall in the blood index should therefore be regarded as an alarm signal. It appears that care must be taken to avoid obtaining samples of blood during the menstrual period. The best time has been found to be immediately following the cessation of the menstrual period, as fluctuations may occur during the pre-menstrual stage. In 13 per cent. of cases, or 12·5 per cent., if the 1 case giving a freak rise in the index is ignored, the blood index fell for no apparent reason, and it has been noticed that in these cases there was a high sedimentation rate obtained with a low lymphocyte count. It appears that

the clinical condition, as well as the blood index, must be taken into account when assessing the prognosis in pulmonary tuberculosis in women.

I wish to thank Dr. R. J. Allison for various suggestions and permission to publish this paper, and also Dr. H. A. Crowther for his helpful criticism in preparation of this paper.

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CONSULTATION

By W. BURTON WOOD, M.D.(CAMB.),
Physician, London Chest Hospital.

Joyce H., aged twelve, a schoolgirl, living in a country district, developed a feverish cold early in February, 1933. At the onset of her illness the temperature rose abruptly to 103° F. and Dr. W. H. R. McCarter, her family practitioner, found signs of a dry pleurisy on the right side. Irregular pyrexia persisted for three weeks when the patient spat up 2 or 3 drachms of pus, after which the temperature subsided. The signs of pleurisy cleared, but as râles persisted after the fall of temperature tuberculosis was suspected. At Dr. McCarter's request I saw the child on March 10; she was still confined to bed but appeared to be convalescent.

The subsequent history of an illness which was prolonged over a period of about eighteen months may be divided into four stages.

Stage 1.

The patient was a delicate-looking child, with pale complexion but not ill-nourished. Bilateral middle-ear disease in early childhood had left her almost completely deaf, and she was still suffering from aural discharge on the left side. On physical examination of the chest a few squeaky râles were audible about the border of the left scapula. When the patient was inverted a spasm of coughing occurred and a small quantity of pus was expectorated. Previous examination of the sputum by Dr. McCarter had revealed no tubercle bacilli. A tentative diagnosis of incomplete resolution following pneumonitis of influenzal type was made and X-ray examination advised when the child should be fit to travel.

After the above interview, progress was interrupted by a recurrence of fever and cough. Signs of moisture persisted in the lungs, but by the end of March the patient's condition again improved. Her temperature became normal, she rapidly gained both weight and strength, and though a spell of cold weather would cause a return of the cough, expectoration was only slight in amount and not purulent.

PLATE X

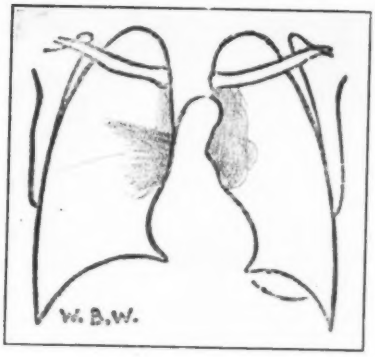

FIG. 1.—SKIAGRAM OF APRIL 27, 1933.

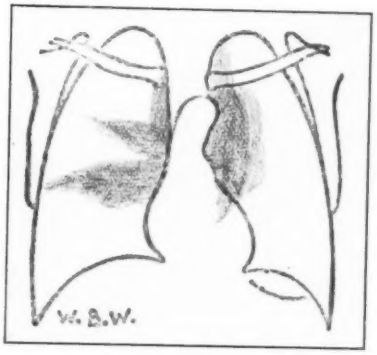

FIG. 2.—SKIAGRAM OF JUNE 12, 1933.

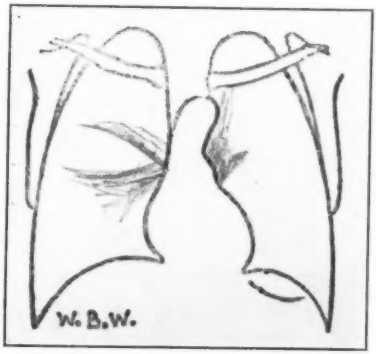

FIG. 3.—SKIAGRAM OF JUNE 19, 1933.

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By the end of April she was fit to travel, and on the 27th Dr. McCarter arranged for her to see me in London. The signs in the chest were still those of slight bronchial catarrh, which now involved both lungs. Some impairment of the percussion note at the level of the lung root on the right side was also noted. X-ray examination, however, proved the existence of more serious disease (Plate X, Fig. 1.)

The skiagram showed a dense shadow contiguous with the upper part of the mediastinal shadow on the left side. Its appearance suggested gross enlargement of the tracheo-bronchial glands. On the right side a triangular shadow based on the hilum spread out into the middle lung field. This conformed with the type usually described by radiologists as "infiltration." Thickening of the transverse septum was also seen.

At this stage the diagnosis seemed to be either tuberculosis of the mediastinal glands or lymphadenoma. The absence of enlarged glands elsewhere, the absence of splenic enlargement, and the X-ray appearances seemed to favour the former alternative. The condition revealed by the rays was, however, by no means typical of tuberculosis. Gross enlargement of the mediastinal glands due to this cause is almost always secondary to a primary focus in the lung. There was no evidence of such a focus on the left side, though the flare shadow on the right side might have indicated a perifocal reaction in the vicinity of a primary focus here. Enlargement of the root glands is not always limited to the side of the chest corresponding with the first infection focus, though it is usually most evident on that side. X-ray evidence of enlargement of tuberculous glands is usually observed on the right side, the right tracheo-bronchial glands being more liable to infection and also more accessible to the rays.

Stage 2.

On May 15 the patient was admitted to the London Chest Hospital for further investigation. At the time of her admission the clinical picture had again changed, and there was now a good deal of cough in the early morning accompanied by profuse sputum. The physical signs in the chest were those of general bronchitis with sibili, heard chiefly in expiration. The patient was still well nourished, nor did she appear to be seriously ill at the time of admission. During the first ten days there was a slight evening rise in temperature to about 99° F. During the next week it was normal, but thereafter a remittent pyrexia developed, varying between 99-100° F. in the morning and 102-103° F. in the evening. Despite the chest signs and febrile state there was no respiratory distress and the respiration rate did not exceed 26.

The results of further investigations in hospital were as follows:

X-ray examination confirmed the presence of mediastinal disease but showed further enlargement of the mediastinal mass on the left side, while a second flame-shaped shadow at the base of the right lung root seemed to indicate a second area of infiltration on this side. X-ray examination in the lateral position supplied no further information as to the site or nature of the lesions (Plate X, Fig. 2).

Examination of the blood (29/5/33) showed:

R.B.C.'s 5,400,000, Hæmoglobin 100 per cent.
W.B.C.'s 14,000, Polymorphonuclears 52 per cent.
Eosinophiles 20 per cent., Lymphocytes 22 per cent.
Monocytes 23 per cent., Basophiles 3 per cent.

A second examination of the blood (12/6/33) showed:

W.B.C.'s 29,000, Polymorphs 74 per cent, Eosin 5·5 per cent.
Lympho. 16 per cent., Mono. 4·5 per cent.
Sputum: No tubercle bacilli found.
Fæces: No tubercle bacilli found, no ova or parasites found, no spirochætes.

On culture non-hæmolytic streptococci and staphylococci were grown. W.R. weak positive reaction.

Thus the evidence obtained from the hospital investigation and the development of the disease still left the diagnosis in doubt. No definite evidence of tuberculosis was forthcoming, while if such an explanation was to be accepted, the severity of the constitutional disturbance with the X-ray appearances could only have indicated the type of fulminating disease which develops on the heels of a primary infection and which is seldom seen except in an infant who has been exposed to massive infection. The two blood counts pointed to a septic infection of increasing severity. The high percentage of eosinophile cells in the first count, in the absence of parasitic infection, is interesting, as an increase of these is sometimes seen in lymphadenoma, but the second count showed a percentage little above the average. The developments seen in the X-ray picture indicated that a third and even more sinister possibility must be considered. These were consistent with a diagnosis of lymphosarcoma. On radiological evidence Dr. J. V. Sparks reported neoplasm, and at this stage I thought he was probably right, though there were no signs of intrathoracic pressure, which are often evident when a rapidly growing tumour involves the upper mediastinum.

As the fever persisted and the child became homesick and miserable

her parents decided to transfer her to her home on June 15, and I lost sight of her for some time. In October, however, Dr. McCarter kindly wrote to me about the case. The stimulus of going home had at first appeared to work wonders, and for about a month the patient continued to gain weight, though the signs in the chest had not cleared. Her general condition improved and the temperature again became normal.

Stage 3.

Towards the end of July, now apparently again convalescent, she was taken to Scotland. Here she had a severe relapse and she became acutely febrile. The cough recurred and was accompanied by copious expectoration of purulent sputum slightly tinged with blood. A physician was called in, diagnosed lymphadenoma and advised treatment by deep X-ray therapy, which, however, was not carried out. An X-ray examination made by Dr. Brown of Aberdeen at this time showed an extension of the lesion in the left upper zone where the shadow had lost the sharp outline previously seen, except in its lowest part. Above it merged into a wedge-shaped area of varying density which contained an irregular clear space, apparently due to a cavity in the lung. The right hilar shadow had become still more diffused, extended further downwards and was surrounded by mottling.

The patient returned home, and early in October Dr. McCarter reported that she was much worse, she was still acutely febrile and the physical signs in the lungs were those of a large cavity in the left apex. At the end of September she brought up ¼ pint of thick yellow pus. She continued to be acutely ill and was rapidly losing weight.

Early in November, when there had apparently been some improvement in her condition, while laughing heartily she was seized with an acute pain in the left side of the chest. Dr. McCarter, hastily summoned, found the signs of an acute spontaneous pneumothorax of the left side with gross displacement of the heart towards the right. The result of this accident was apparently favourable, for during the latter part of October the child was reported to be " extraordinarily well " and gaining weight, though the signs of a large cavity in the left lung persisted.

The story unfolded by Dr. McCarter at this stage still seemed consistent with a diagnosis of neoplasm, the breaking down of which had given rise to an abscess, which on evacuating through the bronchus had led to a temporary improvement. The spontaneous pneumothorax might have been due to a similar cause. It is noteworthy, however, that the relapse was followed by a marked clinical improvement, and the spontaneous

pneumothorax resolved without giving rise to empyema. On the contrary, it was followed by a steady improvement which placed the diagnosis of malignant disease completely out of court.

Stage 4.

By the spring of 1934 the patient was convalescent, and was stated to be free from symptoms. Thereafter she had no further relapse and steadily improved. In June, 1934, she came to see me again. She looked well and her physique was considerably above the average for a girl of her age. On physical examination there were few abnormal signs. There was a slight impairment of the percussion note internal to the border of the left scapula, but no adventitious sounds. During the examination the patient gave a cough and brought up a little purulent but not offensive sputum. Dr. Roodhouse Gloyne reported that this contained numerous cells, chiefly polymorphonuclear in type. Culture showed streptococci, *M. catarrhalis* and *Staphylococcus albus*. X-ray examination showed a gratifying improvement (Plate X, Fig. 3).

The left lung picture was now practically normal, but the right side still showed two triangular shadows spreading like the blades of a pair of scissors. The shadows had lost the soft quality usually associated with infiltration, were linear in type and were evidently cast by pulmonary scarring.

I have not seen the patient since this date, but in December, 1935, Dr. McCarter reported that he had not seen the child for nearly twelve months, during which time she was reported to be perfectly well. She had returned to boarding school in June, 1935, where she is leading the ordinary life of a schoolgirl. Her weight was 12 stone.

Discussion.

A child apparently recovering from an attack of pneumonitis is shown by X-ray examination to be suffering from the results of an infiltrative lesion of the right lung and a tumour in the upper part of the left mediastinum. The tumour disintegrates and the resulting pus perforates a bronchus and is discharged as copious purulent expectoration, a spontaneous pneumothorax probably assisting in its final expulsion. An infiltrative lesion in the right lung resolves and is replaced by scar tissue. When recovery is practically complete, tubercle bacilli are found in the sputum. The whole course of the illness occupied about eighteen months.

Though the early X-ray appearances indicated the possibility of lymphosarcoma or lymphadenoma, the course of the disease enables us to exclude

both, and we are driven to conclude that an acute inflammatory lesion has been responsible. The clinical development of this proves that septic organisms have been at work, but the discovery of tubercle bacilli in the sputum proves that tuberculosis is also concerned.

How can we best explain this curious sequence of events? It seems probable that the process began as an acute infection of the lungs of non-specific type, that a subacute infection of the mediastinal lymphatic system resulted causing a gross inflammatory swelling of the glands, especially on the left side, and that the breaking down of these led to evacuation of the glands which were already harbouring tubercle bacilli. It is probable that the infiltration of the right lung seen in the skiagrams was also of inflammatory origin. Tuberculous perifocal inflammations frequently give rise to similar flame-shaped shadows, but such shadows are softer and less clearly defined, and after resolution they seldom give rise to scar tissue of sufficient density to cast heavy " stringy " shadows on the X-ray plate.

In publishing this case my acknowledgments are due to her doctor, Dr. W. H. R. McCarter, for frequent communications and reports on the patient's progress, and to my colleagues Dr. Roodhouse Gloyne and Dr. J. V. Sparks for their help at one stage in the pathological and radiological investigation of the case.

CLINICAL CASES

THORACOPLASTY FOLLOWING ARTIFICIAL PNEUMOTHORAX

By G. O. HEMPSON,

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THOUGH collapse therapy embraces several entirely distinct forms of intervention, and though in many cases two or more of these may achieve the desired object, there is an enormous gulf between them when the severity of the operation is considered. The surgical risk associated with thoracoplasty will always make the physician hesitate, and the deformity and permanence of the operation make the patient regard it as a last resort. We are frequently prejudiced in our judgment and influenced by the attitude of the patient into making long attempts at dealing with disease by the less severe methods of collapse which are only partially successful, only to be forced eventually into thoracoplasty or the realisation that it is now too late. Sometimes pneumothorax and phrenic evulsion are obvious failures from the start, then the decision is easy; often each is partially successful for a time, only to be followed by relapse. The following case illustrates some of the difficulties.

A clerk, aged forty-six, was admitted with a history of "'flu" five months previously, which was diagnosed as "pneumonia and pleurisy" ten days later. He spent two months in bed and then three weeks in a convalescent home. As he was not fit at the end of this time an X-ray was taken, and pulmonary tuberculosis was diagnosed.

On admission his general condition was fairly good, he was apyrexial and only two pounds below his normal weight. He had a small amount of sputum containing tubercle bacilli, and his blood sedimentation rate was 18 mm. in one hour. X-ray showed infiltration in the upper third of the left lung with a cavity about one and a half inches in diameter.

A left artificial pneumothorax was induced and a partial collapse

obtained, the antero-posterior X-ray giving the appearance of an adherent apex, though the lateral showed good anterior collapse of the lung. Three months later there was still a somewhat indefinite cavity visible.

The clinical improvement was remarkable, the patient was completely free of sputum for four months, his B.S.R. was 3 mm. in one hour, he gained half a stone in weight, and was able to walk three miles a day without difficulty. The question then to be decided was whether to leave things alone hoping that the partial relaxation, combined with sanatorium life, would allow the already smaller cavity to heal completely, or whether to regard complete radiological collapse as essential and proceed to thoracoplasty. His age undoubtedly influenced the decision, but, apart from this, we did not feel justified in advising a thoracoplasty with such a satisfactory clinical result. Nor did we think that the patient would willingly submit to an operation when the only advantage that could be held out to him was a greater security.

However, our hand was forced. Six months after his admission he had a series of hæmoptyses, spread over a period of eight days, and in the last he lost over a pint of blood. By this time his condition would not allow a thoracoplasty, frequent refills up to a positive pressure had no effect, and as some intervention appeared necessary to control the hæmorrhage a phrenic avulsion was performed. There was no further hæmorrhage, the temperature rapidly fell to normal, but the X-ray showed the cavity still present, at a higher level, and with denser walls. There was no increase in the extent of the disease, but he had a persistently positive sputum.

There was now no question that a thoracoplasty would be necessary, the A.P. had proved itself ineffectual, the phrenic operation had made little clinical or radiological difference and the patient had a drachm of positive sputum. However, we had to wait until his general condition improved and to allow the local reaction in the lung to settle, so he was kept in bed for three months and then on exercise for three months, by the end of which time he was nearly back to his previous weight, and his B.S.R. had come down from 38 to 12.

The thoracoplasty was performed in two stages, the A.P. being maintained until after the second stage, though by this time it had practically obliterated. A small pleural effusion appeared soon after the operation, but this was left alone and rapidly absorbed. He made a rapid and uneventful recovery, quickly lost all cough and sputum, and three months later was walking six miles a day without dyspnœa. On his discharge he returned to his former occupation and was very well six months later.

Should we have done the thoracoplasty earlier?

A CASE OF SEMINOMA

By L. S. T. BURRELL,
M.D., F.R.C.P.,
Physician to Royal Free Hospital and to the Brompton Hospital for Consumption and Diseases of the Chest.

The patient, a man of twenty-six, began to have pain in the back in November, 1936. This was followed by swelling of the testicle, which was diagnosed as tuberculous and excised in December. A radiograph of the chest was taken at that time and showed no abnormality.

He lost strength and weight rapidly, and on February 1 X-ray (Plate XI, Fig. 1) showed a large rounded mass in the lower part of the left lung and a few smaller ones scattered in both lungs. A week later a mass was felt in the abdomen above and to the right of the umbilicus, and a few glands could be palpated in the right groin. The possibility of chorion epithelioma was considered, so an Aschheim-Zondek test was performed, but proved negative. Plate XI, Fig. 2, taken on February 25, shows how rapidly the growth multiplied in the lungs.

The patient died on March 25, 1937, after an illness of only four months. At autopsy many secondary growths were found in the liver, the largest being the size of a penny and full of blood. There were over a hundred in the lung, varying in size from a penny to a pea.

Secondary growths were also present in both kidneys and in the abdomen. There was a huge mass arising from the aortic glands in which the intestines were matted. The growth had obstructed the inferior vena cava and there was another mass in the pelvis.

The brain, spleen, and bone tissue were free from growth.

On microscopical examination the growth proved to be a seminoma.

These tumours are described as radio-sensitive epithelial tumours derived from precursor cells of the spermatogonium of the testis. Innes, Harvey, and Dawson (*Edin. Med. Journ.*, 1938, xlv. 36) have given an interesting description of seminoma, which they regard as a carcinoma which shows most of the features of the anaplastic carcinoma of glandular type observed elsewhere. It is closely allied to the teratoma and hypernephroma. The chief clinical interest of this case is the rapidity with which it spread.

PLATE XI

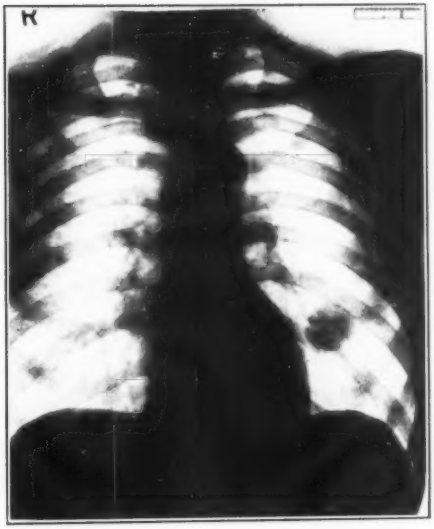

FIG. 1.

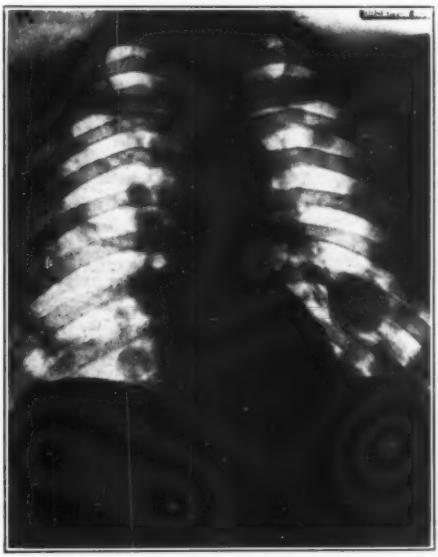

FIG. 2.

[*To face page* 116

MEETINGS OF SOCIETIES

TUBERCULOSIS ASSOCIATION

A MEETING of the Association was held in London on Friday, February 18, the President, Dr. S. R. Gloyne, being in the chair. At the first session a paper was read by Dr. G. S. Todd (Midhurst) on " The Termination of Artificial Pneumothorax Treatment." Pointing out that our knowledge of when this treatment should be terminated was still far from complete, the speaker said he would put forward the views he had himself formed during the last ten years. It was frequently stated that pneumothorax should be kept up for a minimum period of two years and that it could generally be terminated within four years. This, however, was a most misleading statement, since regard must be paid both to the type of lesion for which the treatment was carried out, and also the nature of the primary lesion. In very early cases, with a small amount of infiltration confined to one lung, and where the patient was completely symptomless, obliteration could be safely allowed well within two years, since most of such patients would probably have recovered without active intervention. Cases of fibro-caseous disease limited to half a lung, without definite evidence of cavitation and with little toxæmia, with a blood sedimentation rate about 20 per cent. and scanty but positive sputum—these cases could usually be terminated, if all went well, within an average period of three years. Cases of acute broncho-pneumonic type, accompanied by symptoms of acute general toxæmia and a high S.R., should never be terminated under a period of four years, although the actual duration of the treatment would vary with the progress made in each individual case. In yet another group of patients, those having thin-walled cavities with some infiltration, a raised sedimentation rate, and symptoms of active pulmonary tuberculosis, collapse would have to be maintained as a rule for a longer period in order to produce complete collapse of the cavity or cavities. Finally, in cases of thick-walled cavitation of long standing, A.P. should, if possible, be kept up permanently, on account of the grave risks of reopening the cavity.

The duration of artificial pneumothorax should be estimated from the time of complete and adequate collapse of the diseased lung area, and not from the date of the original induction; and with the reappearance of symptoms or reopening of cavities the time of re-expansion must be revised to date from the re-establishment of complete collapse. As a general rule, re-expansion might be considered when the completely collapsed case had reached what was regarded as a normal period for its type of disease, always with the proviso that the patient had been completely free from all symptoms for at least nine to twelve months, and had a normal temperature and sedimentation rate. Any departures from health, however insignificant, should give warning that healing might not be complete.

Among the complications which might hinder re-expansion or make it hazardous were: (1) Excessive formation of tough fibrous tissue encapsulating a lesion; (2) pleural effusion resulting in a thickened visceral pleura; (3) unequal expansion of upper and lower lobes, in which an apical thoracoplasty might later become necessary. Re-expansion of a collapsed lung should always be carried out slowly, in order to allow the necessary readjustments to take place, and in order to ensure that reactivation of the disease would not occur. Air should be introduced at increasing intervals and in smaller amounts, and each time it should be carefully controlled by screening. If during re-expansion the extra-pleural pressure became too negative, and if re-expansion was causing too much pull upon the diseased lung or too much displacement of heart and mediastinum, phrenic evulsion should be carried out. The process of termination should take on an average from three to six months, according to the previous duration of the treatment.

Abnormal terminations of pneumothorax were sometimes determined on for one of four reasons: (*a*) Contra-selective collapse; (*b*) spread of disease to sound lung; (*c*) presence of effusions; (*d*) presence of other conditions, such as asthma, prolonged dyspnœa, etc. With regard to (*a*) the speaker believed that in very few cases was it necessary to terminate the pneumothorax. Even in (*b*), nothing short of a massive spread to the opposite side would convince him of the necessity of abandoning the original pneumothorax. He was not in favour of embarking on a bilateral A.P. for cases of spread to the other lung, if they could be controlled by other means—*e.g.*, by sanocrysin. With regard to (*c*), a simple pleural effusion should never lead even to a consideration of abandonment of the A.P. Aspiration should not be carried out until the temperature had been normal for ten to fourteen days, unless the effusion became so large that it caused great mechanical displacement of organs, with dyspnœa. Tuberculous effusions presented a very different problem. They should all be gas-replaced as soon as the temperature had been normal for ten days, and if they re-

formed should be gas-replaced at frequent intervals, followed later by pleural wash-outs, these being given in order to help termination of the A.P. by removing thick fibrin from the visceral pleura and by promoting re-expansion of the lung as far as possible. This would greatly reduce the size of the thoracoplasty that would eventually be required. Effusions secondarily infected with other organisms were extremely serious, and the fluid would have to be aspirated daily. Group (*d*): In the presence of asthma or marked emphysema the lung should be allowed to re-expand in the ordinary way, the patient then being treated by sanatorium methods.

In conclusion, the cardinal points to keep in mind were: (1) Never to cease treatment in less than three years in the most suitable cases; (2) to see that the patient was adequately controlled during the re-expansion period; (3) never to cease refills abruptly, and to remember the danger of damage from the needle as the lung approached the chest wall; (4) to remember that the beginning of the treatment must be reckoned from the time of complete and satisfactory collapse, and not from the day of induction; (5) screening and X-ray observation at frequent and regular intervals was as essential during the period of re-expansion as before and during A.P. therapy.

A discussion followed in which several members took part.

Dr. L. S. T. Burrell thought that, broadly speaking, their cases could almost from the beginning be divided into two groups: those who would get well anyhow, and those who would not do well. Looking back over his patients of fifteen years, he found that those who did well at the beginning were well now, while most of those who did badly were now dead. This observation had an obvious bearing on the time to stop an A.P. Many people kept up collapse unnecessarily long. If A.P. did not close a cavity in four years it would not do so in twenty years. Scores of people were carried on far too long; it was either superfluous or useless. A long time ago Dr. Heaf had pointed out that A.P. is not free from danger; every insufflation carried a certain risk. He agreed with Dr. Todd that effusions which occurred in A.P. treatment were true tuberculous exudates, and not mechanical at all.

Dr. C. H. C. Toussaint asked whether it was really advisable that these small terminal effusions should always be aspirated. Would it not be better sometimes to leave them alone?

Dr. E. T. W. Starkie agreed with much that Dr. Burrell had said. The question was often not so much when A.P. should be terminated, but when it should be begun. There was one condition which Dr. Todd had not alluded to—that of black lobe—massive collapse. Presumably these cases would not expand. Then with regard to the hard, thick-walled

cavities, it was surely no use to go on indefinitely with A.P., which was waste of time.

Dr. W. C. Fowler asked why they should not start phrenic evulsion earlier in the treatment. They did this at Pinewood Sanatorium. He thought oleothorax was not sufficiently used in non-infected cases. It was a sound treatment for those whose collapse had to be kept up a long time.

Dr. Andrew Morland was glad that Dr. Todd had had the courage to envisage permanent collapse for certain cases. He thought they ought always to have a clear idea of how much lung tissue had been destroyed before they embarked on A.P. In cases where much lung had been destroyed they should either keep up the pneumothorax permanently or do a thoracoplasty. He was occasionally asked to give up A.P. because the patient got a reaction (raised temperature, etc.) at each refill. But he thought it was unnecessary to cease the treatment on these grounds.

Dr. R. R. Trail congratulated Dr. Todd on his concise presentation of the subject. He disagreed with the idea of maintaining pneumothorax in cases with open cavitation as he thought the dangers greater than those that would follow the submission of the patient to surgical treatment. He regarded continued pleural wash-outs in recurring pleural effusion containing tubercle bacilli to be unjustified unless with the definite object of re-expanding the lung before surgical intervention. He did not agree with Dr. Fowler that phrenic evulsion should be done earlier.

Dr. W. Burton Wood agreed that they should consider the condition at the beginning of the treatment before considering when it should be terminated. They often had patients cast on to them for refills with no indication as to why it had been originally started and what was the condition of the lung at the time.

Dr. N. L. Rusby thought the presence of effusions was helpful, and that the substitution of oleothorax was superfluous and even dangerous.

Dr. S. Vere Pearson said he had been impressed by the fact that Dr. Todd recommended that A.P. treatment should not be discontinued in contralateral collapse. He asked how often Dr. Todd had come across a pneumothorax which had *not* been induced. In connection with some remarks made with reference to strain on the other lung, he suggested that some notice should be taken of the age of the patient. There were two kinds of emphysema. One was a normal overgrowth in young patients as a compensation for collapse in the other lung. No bullæ were present in these cases. He was inclined to think Dr. Todd was perhaps too keen on wash-outs. With regard to abandonment of A.P., Dr. Pearson mentioned the case of a patient of his who went on for twenty-two years or more, and

had remained well until recently. Phrenic evulsion should be undertaken with an eye on the original lesions.

Dr. J. Watt differed on one point from Dr. Todd. He did not think that an A.P. should necessarily be carried on for a minimum of two years. In a case of A.P., which was doing well, six months seemed to be long enough. It was often doubtful whether a case was suitable for A.P. or not. No rule of thumb was possible.

Dr. Peter Edwards said the main question was when to do the A.P. rather than when to stop it. The procedure was still not carried out nearly as often as it should be, at least in the country. When did they ever have the privilege of letting the lung out? This was practically always arranged for them by Providence. Not one of his own A.P. cases had been lost sight of; he had kept in touch with them all. A complete A.P. was often not enough. When combined with intelligent phrenic evulsion the results were often astonishing. Disease on the opposite side was never an indication for ceasing on the first side. He himself would often do a bilateral pneumothorax. Most massive collapse cases did extremely well; the results were extraordinarily good.

In a brief reply Dr. Todd said that once it was seen that A.P. could do nothing, they must try something else. If cases of massive collapse were left without treatment there was often pain which insufflations would relieve. He agreed with Dr. Fowler as to the value of phrenic evulsion early in the treatment. He personally would like to do a phrenic evulsion in nearly 100 per cent. of cases.

At the evening session a series of short papers were read.

Dr. J. V. Hurford (Colindale) spoke on "Hypovitaminosis C in Pulmonary Tuberculosis," and discussed the results of an investigation on 66 patients at Colindale Hospital. Taking the minimum normal limit of excretion of vitamin C in urine as 14 mgm. per twenty-four hours, it was found that 64 per cent. of the patients tested showed a hypovitaminosis, 25 patients having a daily excretion below 8 mgm., and only 10 of the 66 patients excreting 20 mgm. or more. Among the possible factors responsible for the deficiency noted, diet did not apparently play a leading part. With large test doses of ascorbic acid (equivalent to from one to two pints of orange juice) only 50 per cent. of the patients showed a rise in the excretion above the minimum normal reading. Nor did pyrexia prove a factor, since 50 per cent. of the patients tested were apyrexial, and almost 15 per cent. of those with fever had a normal excretion. Deficient absorption of the vitamin due to altered intestinal chemistry or bacterial infection of the intestine seemed a reasonable theory, but was discredited because the excretion was the same whether the route was oral or intravenous, and also

because in only 10 per cent. of the C-deficient cases were there any symptoms suggestive of an enteritis. Discussing the question whether hypovitaminosis C reflected the clinical condition in pulmonary tuberculosis or could be used as a guide to prognosis, the speaker had found no constant relation between vitamin C excretion and the sedimentation rate, Von Bonsdorff count, or the extent of the disease; nor did the response to test doses over a short period give any guide to the clinical condition.

As regards treatment, ascorbic acid was given to 42 cases for either a short period (two to four days) or for periods ranging from one to three months. In neither group did the treatment produce any significant effect on the S.R. or on Von Bonsdorff count. The Mantoux reaction was also unaffected by test doses over a short period in 27 patients.

In 7 cases showing a microcytic anæmia, large doses of vitamin C effected a significant improvement. While most of the findings were thus negative, the speaker suggested that since in tuberculosis there is a definite nutritional defect, it would be foolish, in a disease which takes so long to treat, not to attempt to correct this, especially as the low excretion of vitamin C appears to indicate increased need of the tissues for it, for some purpose which is not yet clear.

In a brief discussion which followed, Mr. J. E. H. Roberts said that the speaker appeared to be calculating excretion without any relation to the intake of ascorbic acid. The intravenous route had been shown to be useless, since the whole of the ascorbic acid was promptly excreted in the urine. He had been informed that once the patient was saturated, the juice of two oranges daily was sufficient to keep the patient with a normal reading. Other speakers asked how long the patients had been staying in the sanatorium before they were tested, and whether experiments had been tried with orange juice instead of ascorbic acid, which some believed to be inert.

Dr. Hurford, in reply, referred to a patient with a normal excretion of vitamin C in his urine although he never took fruit or vegetables. He agreed that a basic diet was necessary, and said that the length of stay in hospital in every case had been at least four weeks before testing, and many of them much longer than this, so that they had every opportunity of getting used to the hospital diet. He had made some investigations with orange juice, and allowing for the much larger doses required the results were more or less comparable.

Dr. E. K. Pritchard (Southwark), whose paper was entitled "The Value of Contact Examination," said that he would really like to have called it "The Limited Value of Indiscriminate Contact Examination," since he firmly believed that the examination of contacts of tuberculous

patients was futile unless it was intelligently carried out. It was, doubtless, a platitude that the primary object of contact examination was to find the original source of infection and to discover hitherto unsuspected cases of the disease. Theoretically the ideal procedure might be a bi-annual examination of every contact of every tuberculous patient and a compulsory weekly sputum test; but such a scheme was obviously completely impracticable. Even were it not so, it would probably have no greater ultimate effect on the incidence of tuberculosis than a careful examination restricted mainly to the adolescent and the adult contact. Such an examination should be conducted with as much care as that of a new case sent up for diagnosis. A careful history should be taken, sputum examinations made, and a radiological examination carried out. For reasons of economy screening might be sufficient, provided a film was always taken in doubtful cases. The speaker urged that the X-ray plant should be actually in the dispensary, contact work alone amply justifying the expense. Farming out work did not enhance the reputation of a dispensary. Routine contact examination he looked upon as unnecessary and even undesirable, tending as it did to produce a permanent feeling of apprehension. The examination of adolescents was important because of the severity of the disease at this age period; and of possibly even greater importance was the examination of other adult contacts in the home, by which examination the primary infector might be discovered.

While the examination of adolescent and adult contacts justified the time spent on it, the speaker was doubtful whether this applied to children. Pulmonary tuberculosis was not common in children up to school-leaving age, and the welfare clinics and school medical service had them under observation, referring any doubtful cases to the dispensary. Child contacts should, however, be supervised at the dispensary if the parents were unable or unwilling to avail themselves of the facilities offered by the boarding-out scheme or open-air school. Finally, the speaker urged that the efficiency of contact work should no longer be judged by impressive but meaningless figures, but that the quality of the work, and the discrimination used in it, should be given greater recognition.

After the paper was read, several members expressed their agreement with Dr. Pritchard's contention that the examination of patients between the ages of fifteen and twenty-five was of paramount importance. Dr. Blythe Brooke added that he thought regular examinations should be made every two years. Screening was useful, but films were specially valuable for purposes of comparison when the patient was seen again at a later date. He also thought there was a certain value in examining school children once or twice during their school years. Dr. Hebert thought that no appreciable

progress in contact examination would be possible until they had evolved some method of distinguishing those who were likely to develop tuberculosis later on.

Dr. Pritchard, in reply, said the question of expense would prevent the authorities from sanctioning an unlimited number of films, while Dr. Blythe Brooke's other suggestions—routine two-yearly examinations and the examination of school children—were impracticable from the amount of extra work they would entail. The whole point of his paper was that they should be allowed more time and facilities for the proper examination of adolescents and young adults.

Dr. W. M. McPhail (Burrow Hill), who had chosen for his title "The Symptomatic Treatment of Phthisis—a Lost Art," said his subject was less the treatment of symptoms than the modern change of attitude towards them. His own interest began in reading some of the works of the giants of the nineteenth century, whose work was indeed out of fashion, but could never be out of date. He had been struck by the different attitude displayed by them towards symptoms, and he asked why had symptoms ceased to be of interest to modern phthisiologists. The subject was comparatively neglected in modern textbooks and articles in current literature and was seldom touched on at meetings of their own Tuberculosis Association. The middle of the last century was the great age of morbid anatomists, whose observations were extremely accurate; and as much importance could be attached to their reports of cures as to those reported in these days. Among the causes responsible for this change of attitude was, first, the altered outlook illustrated by the title of the recent Presidential address, "From Consumption to Pulmonary Tuberculosis"—*i.e.*, a change from a well-defined clinical entity based on morbid anatomy, to a large group of clinical conditions based on a bacteriological conception. Another cause was the recent rapid and rather haphazard development of the anti-tuberculosis survey service leading to less continuity of interest. Formerly there was one physician for the individual patient; now the patient was referred to various specialists and institutions. Studies of phthisis in the old days were studies of individuals; now there were studies of the aspects of disease in large groups of patients. Symptomatic or palliative treatment was an art which was neglected, and was in danger of being forgotten or lost. Advanced and chronic patients were less well off today in the way of treatment than they were formerly, and the speaker urged that practitioners and hospital residents should get a better lead from experienced phthisiologists, and that discussions on symptoms should be included in the programmes of the Association.

In a short discussion which followed one or two speakers deprecated

the modern "mechanisation" of tuberculosis; a knowledge of mechanics and of hydraulics and other branches of science appeared to be required by the phthisiologist. Dr. Heaf asked what they had in the pharmacopœia with which to treat symptoms. They had only four or five really useful drugs. We were living in an age of short cuts; symptoms were all tabulated and marked on the charts with a plus or minus sign and there it ended. Mr. Roberts said that as a surgeon he would put in a kind word for the physicians. They were now taught to treat causes rather than effects—causes than symptoms. Another speaker pointed out that in the nineteenth century there were doubtless far more cases acutely ill and suffering from the lungs than in the last twenty years. The value of open air and of rest was not fully understood then; these methods of treatment undoubtedly mitigated most of the symptoms that used to be common.

Dr. W. D. W. Brooks (St. Mary's Hospital) followed with a paper on "An Ancillary Method in the Treatment of Pulmonary Tuberculosis." Pointing out that in artificial pneumothorax therapy the presence of adhesions frequently prevented the attainment of selective collapse, and that in any case such collapse was beyond the control of the clinician, he suggested that a method which would bring selectivity of collapse within control might well be an advance in the treatment of the disease. The method outlined in his paper consisted essentially in temporarily obstructing the bronchus to the diseased area. He was at present of the opinion that the presence of a pneumothorax was essential in order to prevent the development of a very considerable negative pressure between the layers of the pleura, which in turn would lead to bronchial dilatation in the collapsed area. After passing a bronchoscope, a special double catheter is introduced into the bronchus supplying the diseased lobe. A rubber collar encircling the distal end of the apparatus is then inflated through its catheter with 30 per cent. NaI, gentle traction sufficing to show that the bronchus is firmly occluded. The proximal end of the tube supplying the collar is then closed and the bronchoscope removed. Suction is now applied through the other tube of the catheter and air is removed until a mean pressure of – 30 cm. of water is attained and maintained. The proximal end of this tube is then closed. The blood circulating through the area of lung supplied by the bronchus which is thus occluded absorbs the remaining contained air and complete selective collapse is obtained—usually within six hours and sometimes much less. When collapse is obtained, the taps at the proximal end of the catheter are opened and the collar allowed to deflate, when the catheter is removed. Of 10 cases who had received this treatment, including 8 cases of basal phthisis, complete selective collapse occurred in 6, in each of whom the collapse had persisted.

So far, the longest period had been six months. Should re-expansion occur before it was thought desirable, there seemed no reason why the procedure should not be repeated. In none of the 10 cases had there been any serious consequence attributable to the method, and in 8 there was no reaction of any kind.

Dr. Brooks showed slides illustrating 5 cases in which selective collapse in artificial pneumothorax therapy had been obtained in this way.

Owing to the lateness of the hour there was very little discussion after Dr. Brooks' paper. It was generally agreed that the method was well worth a trial, especially when lower lobe cavities were present, or for tense thin-walled cavities where other methods had failed.

Dr. G. Day (Mundesley), in his paper on " Some Experimental Observations," confined himself to a discussion of the effects of sunlight and of ultra-violet light from a mercury vapour lamp on the human body, including the results of overdosage deliberately tested on himself. Clinical tests on debilitated " chesty " children and on others with enlarged cervical glands showed that erythema doses gave the maximum benefit, the criterion being gain in weight. Asthmatics obtained relief, those developing pigmentation gaining the most lasting benefit. Graphs were also shown of patients suffering from tuberculous pleurisy with effusion who began to improve in temperature, weight, and sedimentation reaction from the time the mercury-vapour lamp was first used in careful dosage. The speaker had come to the conclusion that the procedure of sunning patients was perfectly safe, provided that they began with a sub-erythema dose and ceased treatment immediately at the slightest feeling of discomfort.

The Annual Provincial Meeting of the Tuberculosis Association will be held at Oxford on April 7, 8, and 9.

The following programme has been arranged:

Thursday, April 7.

2.15 *p.m.* Papers on " Incidence of Tuberculosis in Young Adult Women with Special Reference to Employment," by J. Heimbeck, M.D. (Oslo); H. H. Bashford, M.D., M.R.C.P. (Chief M.O. to G.P.O.); Campbell Faill, F.R.C.P. (Ed.) (Bristol); Miss G. M. Bowes (Matron, Birmingham Hospital Centre).

4.30 *p.m.* Tea, served in the Laboratory.

5 *p.m.* " Problem Cases," by Professor Girdlestone, F.R.C.S.; W. Stobie, O.B.E., M.D., F.R.C.P.

Evening. Suggested Entertainments: New Theatre; Crown and Thistle, Abingdon; Trout Inn, Godstow; Dog House, Frilford Heath.

Friday, April 8.

9.45 *a.m.* Papers on " Extra-Pleural Pneumothorax," by R. C. Brock, M.D., F.R.C.S.; T. H. Sellors, D.M., F.R.C.S.

11 *a.m.* Papers on "What can be done to Prevent the Tuberculous Patient Relapsing," by G. C. Williams, M.A., D.P.H. (M.O., City of Oxford); H. G. Trayer, M.B., D.P.H. (M.S., Baguley Sanatorium); F. H. Young, O.B.E., M.D., F.R.C.P. (T.O., City of London); Neville Irvine, D.M. (General Practitioner, Henley); A. M. Cooke, D.M., F.R.C.P. (Cons. Physician, Oxford).

2.30 *p.m.* Visits to Wingfield Morris Hospital and Osler Pavilion (coaches will leave the Clarendon Hotel at 2 p.m.).

4.30 *p.m.* Tea at Osler Pavilion.

7 *p.m.* At Exeter College. President's Reception.

7.30. *p.m.* Annual Dinner.

Saturday, April 9.

10 *a.m.* Papers on "The Progress of Radiology," by Felix Fleischner, M.D. (Vienna); Miss Clark, M.S.R. (Ilford's, Ltd.); A. E. Barclay, O.B.E., M.D., M.R.C.P. (Oxford); K. J. Franklin, M.D.; R. G. Macbeth, F.R.C.S.

12 *noon.* Papers on "Tomography," by Hilary Roche, M.D., M.R.C.P.

12.30 *p.m.* Annual Meeting.

NORTH-WESTERN TUBERCULOSIS SOCIETY

A MEETING of the Society was held in the Tuberculosis Offices, Manchester, on January 27, 1938, with Dr. G. Jessel (President) in the chair. Dr. G. Stanton Gilmour gave a paper on "The Chronicity of Lesions in New Cases—particularly Young Adults."

Dr. G. Stanton Gilmour said that the new cases of pulmonary tuberculosis admitted to a sanatorium or seen in a tuberculosis clinic fell into two categories: those with and those without gross evidence of a chronic background.

The percentage of new cases with chronic lesions in the young adult (Group 15-25) was increasing. All these cases must have been contacts of positive cases either known or unknown, and were infected either during school period or after leaving school. Contacts to known positive cases should be easy to deal with provided they were not lost sight of merely because they showed no evidence at the first examination. The investigation of children at school-leaving age offered a broader field. Dr. Gilmour suggested a more complete physical examination of each child on reaching school-leaving age, including X-ray examination, tuberculin test, and possibly blood examination. With regard to X-rays, he said that a standard technique was needed and a better quality of film. Of those children who had a positive Mantoux reaction some might be safe and have lifelong immunity, while in others the constant repetition of contact with the source of the original infection led frequently to a breakdown of immunity and the evolution of active disease. It would therefore always be worth while to trace, if possible, the background of positive tuberculin reactors, and many

non-notified cases would thus be found. Those with negative tuberculin reaction at school-leaving age should be watched until they became positive and for a period after this until they were apparently safe. The present schemes would have to be augmented in order to observe these cases during the young adult decade. Experience would determine the frequency of examination and the ultimate period of observation. Dr. Gilmour referred to the part played by poverty and overcrowding in the incidence of tuberculosis. He stressed the deleterious effect of overtime in industry, especially during the period of final growth. Physical exercise, in itself beneficial, was frequently harmful when combined with overtime. With the means at our disposal, Dr. Gilmour said, it was impossible to isolate the ambulant positive case in industry and at home. It would, however, be cheaper for the nation to subsidise the sputum-positive cases to keep them out of industry than to maintain the present cost of tuberculosis, which is largely due to infection by contact which is avoidable. In the home poverty prevented the patient from making practical use of his sanatorium education. In particular, the subsidy of the T.B. plus housewife would seem to be economically worth while.

It was recognised that there had been a change in the quality of immunity, due largely to industrialisation and the general health measures of the last half-century. It was now possible for an individual to be infected with T.B., and by its activity to suffer serious damage to lung tissue for a long period before subjective symptoms or obvious deterioration in general health drew attention to the disease. This happened particularly in the young adult decade. This insidious form of the disease must be diagnosed before subjective symptoms arose.

In the discussion which followed Dr. H. Midgley Turner said that in 60 per cent. of tuberculous adults there was no known source of infection. He said industry offered a likely source of infection, and it should be made possible for tuberculosis officers to explore this field more thoroughly. He thought that employers should require a certificate that the disease was quiescent before taking back a tuberculous employee. Dr. Midgley Turner said that the intensive following-up of children presented a big problem, as they formed about one-sixth of the total population, and that the cost of X-rays, etc., would be very high. He agreed with Dr. Gilmour that it would be cheaper in the long run to subsidise the tuberculous positive worker in order to keep him out of industry, and he advocated colonist settlements. He urged the necessity for adequate sleep, which, he said, was often curtailed by overwork and overplay.

Dr. Pask said that in view of the falling death-rate in tuberculosis, we were apt to view the tuberculosis problem with complacency. He depre-

cated the present "Keep Fit" campaign, which, he said, laid too much stress on physical jerks and not enough on hygiene. Referring to tuberculous contacts with bad family histories, he said that it was impossible to say how long they had had the disease when they first came for examination.

Dr. Winniefred Gray, speaking as a school medical officer, said it was important to examine the school staffs to exclude any members who might be tuberculous. She referred to the difficulties in persuading children to go to the tuberculosis clinic for supervision, especially after they had been certified as free from tuberculosis on their first attendance. She suggested the term "Preventative Centre" in preference to "Tuberculosis Clinic." Dr. Gray said that often children had to travel long distances to school, and that they did not get enough rest. She advocated day boarding-school systems.

Dr. E. N. Ramsbottom said that in the young adult group (15-25) the number of males with tuberculosis was decreasing and that the number of females with tuberculosis in this group was increasing. He said females were especially liable to the disease on beginning work. He referred to a large number of cases with pleurisy and pleural effusion who had been in hospital and had had fluid removed which had been tested for tubercle bacilli with a negative result. These cases had been discharged as non-tuberculous.

Dr. Ramsbottom was of the opinion that all these cases should be sent away to sanatorium, and that this type of case in the municipal hospitals should be referred to the tuberculosis officer.

Dr. A Scott, referring to tuberculous young adults, said that in his experience it was usually the acute case that had a tuberculous family history. The case with the chronic type of disease had very rarely a family history of tuberculosis.

Dr. G. Jessel referred to the chronic case, which, lacking all symptoms, continued to work and reached middle age before diagnosis was established. He suggested periodical examinations and greater education of the public in general health measures.

Dr. P. Edwards, proposing a vote of thanks to Dr. Gilmour, said that it was difficult to persuade patients to go to colonies. He agreed that it was important to trace the source of infection. He said that in his experience the tuberculous home furnished more cases of tuberculosis than did the non-tuberculous.

Dr. A. Adams, in seconding the resolution, deprecated the "Keep Fit" campaign and alluded to the dangers of so-called "hiking." He said it was more important to teach domestic hygiene and household management in the home.

THE JOINT TUBERCULOSIS COUNCIL

THE Council met on February 19, 1938, Dr. S. Vere Pearson being in the Chair. Dr. W. H. Tytler, convener of the sub-committee on Sputum Examination, reported on the work which had been done. It included all forms of sputum examination with special reference to culture, and the Council decided to publish the report.

Dr. Ernest Ward presented his report, which was a summary of the work done by the Council during the last two years. Dr. Ward has been Secretary to the Council since it was formed fourteen years ago, and it is with great regret that his resignation of this post has been accepted. Dr. Pearson, the present Chairman, and Dr. G. Lissant Cox, the previous Chairman, referred to the work Dr. Ward had done, and tendered him the appreciation and thanks of the Council. Dr. J. B. McDougall is the new Secretary.

Dr. Lissant Cox and Dr. Esther Carling brought forward the memorandum on the evidence to be given to the Interdepartmental Committee on Nursing Services. This has special relation to the nursing problem as applied to tuberculosis institutions.

The Joint Tuberculosis Council also organises post-graduate courses on Tuberculosis. These are arranged by Dr. Brand, and it is hoped to continue them during the coming year. Particulars may be obtained from the Secretary.

After the meeting members of the Council, representatives of the Press and other bodies interested in tuberculosis were entertained to lunch at the Russell Hotel by Dr. S. Vere Pearson, the Chairman. After lunch Dr. Pearson explained the objects of the Council, the work done and the problems which they have before them.

REVIEWS OF NEW BOOKS

The Radiology of Pulmonary Tuberculosis. By J. E. BANNEN, M.B., CH.B., D.M.R.E., Hon. Radiologist Hull Royal Infirmary, Radiologist Hull Corporation Hospitals and Tuberculosis Clinics. London: Baillière, Tindall and Cox, 1937. Pp. viii+156, with 39 illustrations. Price 12s. 6d.

The interpretation of chest radiographs is a matter of great difficulty and there is a need for a book of this type. The author points out that hilum shadows may vary greatly within the normal limits and that the term root fibrosis is almost a misnomer. The late Dr. Stanley Melville, a pioneer of thoracic radiography, used to warn his students against the term hilum tuberculosis or peribronchial fibrosis so often applied to a normal radiograph.

The author insists on a careful technique with quick exposure, and says that to make comparison possible each film in a series should be taken under precisely similar conditions.

Descriptions are given of various shadows found in tuberculosis, such as Ghon's focus, epituberculosis, broncho-pneumonic and miliary tuberculosis, atelectasis, etc., and the illustrations are well produced.

The author clearly does not agree with the saying that "the treatment of tuberculosis is the treatment of cavities," for only a few lines are spared to cavitation and tomography is barely mentioned.

There is a chapter on differential diagnosis and one on the clinical aspects of pulmonary tuberculosis.

The radiographic appearances of pneumoconiosis are well described, as are the changes which take place when tuberculosis supervenes.

Le Traitement de la Tuberculose Pulmonaire par la Tuberculine. By D. M. JAQUEROD. Lausanne: Librairie Payot et Cie., 1937. Pp. 43 and 4 radiographs. Price 2.50 Swiss francs.

The first attempts at the treatment of pulmonary tuberculosis left a very doubtful impression on the medical world, and this unfavourable view has persisted until today, in spite of the fact that the method introduced by Koch has since been completely modified, and in the hands of capable specialists has given satisfactory results.

Dr. Jaquerod, who used tuberculin for more than twenty years, has given us, in this book, a résumé of his long experience. He is a great believer in tuberculin therapy, nevertheless he insists on the dangers of this treatment if the dosage is too great or if used on patients who are unsuitable.

The question of indications and contra-indications and the method of giving tuberculin are discussed in this work with complete frankness, and careful instructions are given so that it may be used with the maximum chance of success and the minimum risk of harm to the patient.

Massage and Remedial Exercise. By NOEL M. TIDY. Bristol: John Wright and Sons. Third edition, 1937. Pp. 456 with 178 illustrations. Price 15s.

The fact that this book, which was first produced in 1932, has already reached its third edition bears testimony to its popularity. It is intended for senior students and for those recently qualified and for junior teachers in training for the Chartered Society's examination. Chapter XXII. deals with diseases of the respiratory organs, and gives a detailed account of breathing exercises.

The book is well produced and illustrated and contains much practical information.

A Practice of Orthopædic Surgery. By T. P. MCMURRAY, M.B., M.CH., F.R.C.S.(Edinburgh), Director of Orthopædic Studies and Lecturer in Orthopædic Surgery, Liverpool University. London: Edward Arnold and Co., 1937. Pp. 471. Price 21s.

This is a practical book in which, unlike many medical works, due space is given to treatment. It does not include details of complicated operations nor does it deal with fractures, for the author thinks these subjects deserve a separate volume. Four chapters deal with tuberculosis of the bones and joints. He regards trauma as an important predisposing cause of tuberculous arthritis, which occurs most frequently in the joints much liable to injury, and is more common in boys than girls. The spine is the most common site, and includes some 45 per cent. of all tuberculous joint affections. The author devotes fourteen pages to this condition, and discusses fully the treatment and complications of which paraplegia is the most serious. With proper treatment the prognosis in children is good even when paraplegia has occurred, but it varies with the degree of deformity.

There are numerous illustrations, which are excellent, and the book concludes with a useful index.